JUL 27 1925

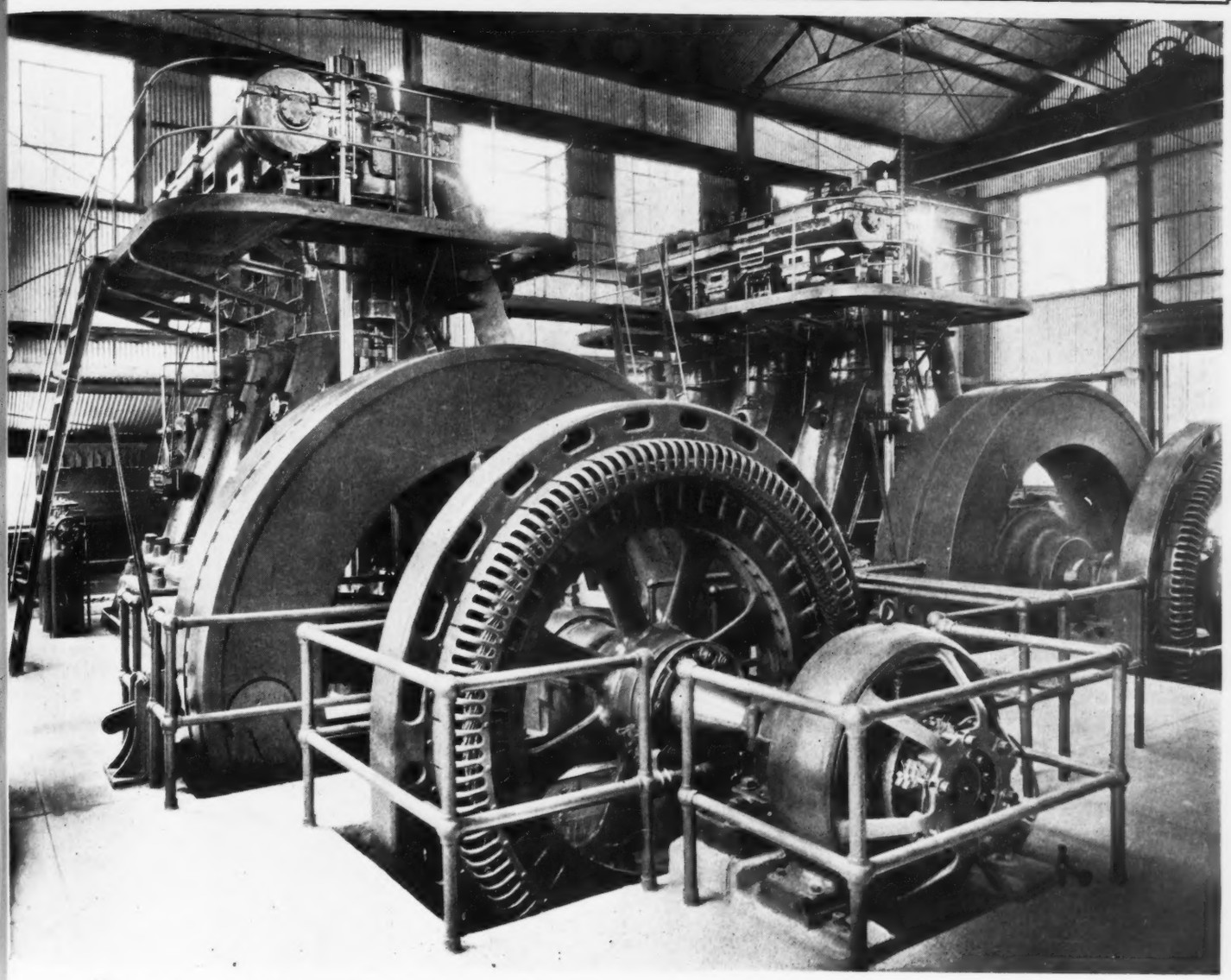
July 25, 1925

McGraw-Hill Company, Inc.

Twenty-five Cents Per Copy

ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS



The power plant of the Iron Mountain Co., Iron Mountain, Mo., contains two 520-hp. three-cylinder Diesel engines, each driving an alternator

The Diesel Engine in the Mining Field

Its Position and a Study of Its Possibilities

By Felix Edgar Wormser

Differential Flotation of Copper and Iron Sulphides

By Harmon E. Keyes

Useful Operating Ideas
Discussion
Current Prices of Materials and Supplies

SACON CARRIER

The
SACON CARRIER

That never-ending search for things superior....

The relentless reaching out for a higher state of mechanical refinement....

Attention to standards of performance which must be surpassed....

Many factors have supplied the **mental urge** for this superior belt conveyor carrier.

Expect new operating records from this new product developed by S-A Engineers.

Bulletin No. 143 describes the Sacon Carrier in detail. Write today for a free copy.

Belt conveyors serving your plant must be dependable. *Use Sacon Carriers.*

DESIGNERS & BUILDERS OF LABOR SAVING MACHINERY

2

STEPHENS-ADAMSON
MFG. CO. AURORA, ILL.

ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 120 | New York, July 25, 1925 | *Number* 4

Outward Flow of Gold and Goods

FROM THE CROP of reports emanating from Washington at the close of the first half of the current year some significant figures may be culled. The excess of gold exports from, over imports into, the United States was $114,584,000 for the twelve-month period ended June 30. This compares with an excess of imports for the preceding twelve months, amounting to $406,818,000. In fact, the net "outgo" since Jan 1, 1925, has been about $175,000,000. Moreover, during the year ended June 30, we sold to foreign countries goods having a value of more than a billion dollars in excess of the value of our imports from abroad. This is $285,000,000 more than our "favorable" trade balance in the year immediately preceding. One of the factors in this increase, incidentally, is the large improvement in the volume of copper exports, particularly to Germany.

Our net "loss" in actual gold bullion and in commodities is considerably more than a billion dollars. In exchange we have received the services of foreign peoples rendered to American travelers abroad—equivalent to a sum running annually into hundreds of millions—and we have absorbed foreign securities in large volume.

In some quarters the net loss of gold is viewed with apprehension on the theory that a diminution in our gold supply will tend toward a painful deflation. However, there has been no uniformity in the relation of our price level and our stocks of gold bullion for many years. Sounder reasoning indicates that we can easily afford to let go another billion of the four billion visible gold supplies now available before there will be any reason for worry. Moreover, the only apparent way in which finances in foreign countries can be stabilized is by building up a reserve of actual metal to which a gold standard can be anchored. The problem is not to dam the outward flow of gold, but so to direct the flow that it is likely to stay where it will do good rather than gravitate back to us.

The increase of our surplus of exports over imports in itself is not ground for unalloyed congratulation. Europe owes us money, much money, which we hope to collect. Ultimately she must pay in service or in merchandise—a large part of which necessarily must be manufactured, because of her limited supplies of raw material. So long as we continue to export more goods than we import (as a consequence of our policy of excluding manufactured products so far as practicable), the only important medium of payment will be service rendered to Americans abroad. That this medium will prove adequate is not to be expected. Sooner or later Europe must be enabled to produce and to export a surplus if she is to pay. The pre-war rôles of Europe and America are reversed. The United States now is the creditor nation. How long this condition will last or what the results, no one knows. The situation is one that commands the best brains in the country; but hoarding gold bullion in bank vaults in the United States will not help.

Bauxite et al.

A NEWS DISPATCH in the *Journal of Commerce* says that Secretary Mellon is to be asked to use his influence with the Aluminum Company of America, which his family controls, to obtain cargoes of bauxite ore for Shipping Board vessels of a certain line that runs between the Guianas and New York. It is only the excess tonnage, that cannot be shipped in the Aluminum Company's chartered steamers, that is sought. This seems a very unimportant matter, save for the particular steamship line concerned. In 1924 a total of 201,000 tons or thereabouts of bauxite was brought into the United States, so the transportation company can hope for only a comparatively small tonnage at most. It is unfortunate that so prominent an official as the Secretary of the Treasury should be importuned with trivial requests for his help or influence. A shining mark draws attention, however, and the Secretary without doubt has influence in government circles as well as in the Aluminum Company's offices, as the increased tariff on aluminum and aluminum products bears witness.

It is from Arkansas and from the Guianas that the Aluminum Company is drawing the bulk of its bauxite ore at present. It has deposits in other parts of the world and is steadily acquiring new ones. Thus it adds to its future supply, and with business sagacity prevents these deposits from falling into the hands of possible competitors. About seven months ago, it is reported, it acquired, through a joint purchase of the Republic Carbon Co., a deposit in the Guianas in the center of its holdings, and elsewhere in these countries deposits controlled by the Norton Company of Worcester, Mass. Competition is not at all impossible, however. All it necessitates is power, bauxite and abundant capital, a combination of graces that is difficult to find, though possibly in existence.

Truth and Its Risks

THE ADAGE that the rose by any other name would smell as sweet is at variance with the law of libel. Terms and wording used in discussing nefarious acts must be chosen carefully. One who has served a term in jail may not be called a jailbird needlessly, and in many similar cases the inexperienced writer will be surprised to find what restraint is needed. All this is a safeguard to protect the name and reputation of the honest. Reputation is a fragile thing. "Honor," said Hudibras, "is like that glassy bubble, that gives philosophers such trouble; whose one part

cracked the whole doth fly, and wits are cracked to find out why."

Thus truth may not be spoken at all times, especially where it is difficult to prove it. Promoters of wildcat mining ventures and others who use dubious methods of selling stock find in the libel law a measure of protection from scathing criticism that might otherwise justly come upon them. It saves the day for truth at times that such people generally do not dare go into court.

Simplification in Copper Ore Concentration

DURING the last two years remarkable progress has been made in the simplification of the flow sheets in sulphide copper ore concentration. Table concentration is disappearing and in its place all-flotation is becoming rapidly established. The efficacy of potassium xanthate as a conditioner has played an important part in bringing about this result. The raising of the grade of the concentrate produced by eliminating barren pyrite is an important feature of recent work. This has been accomplished in part by avoiding table separation and in part by resorting to selective flotation.

So far as low-grade sulphide copper ores are concerned, milling practice is approaching the following: An initial grinding stage receiving a ½-in. roll product, followed by a second grinding stage in closed circuit with drag classifiers. The overflow of the classifier after receiving additions of xanthate and pine oil passes through several flotation separators in parallel, which make a finished concentrate and a tailing. The tailing is sent through a secondary series of flotation separators in parallel. These make a finished concentrate or a middling, or both. The middling product is passed through a cleaner, making a finished concentrate and a product that is returned to the secondary flotation cells. In some instances secondary flotation can probably be omitted and perhaps close enough control can be maintained to restrict flotation to a single stage without cleaners. In other instances cleaners may be required.

Many engineers believe that coarse crushing should be carried beyond the present 1½-in. or 2-in. product and that no product coarser than ½-in. size should be delivered to the ball or rod mills, and we are inclined to agree. They think that fine grinding in a single stage in closed circuit with drag classifiers is preferable to double-stage fine grinding. The latter entails more or less complication in mill design, whereas the former allows a simple grinding floor arrangement.

Although tabling has been abandoned in many of the low-grade copper ore concentration plants, we believe it still has a place in the treatment of higher-grade ores, and especially those characterized by coarse dissemination of the ore minerals and accessory gold and silver. Tabling quickly removes a large proportion of the heavy minerals and does this economically, the product being especially acceptable to the smelters. Nevertheless, in some instances, the gain in plant simplification by the omission of the table floor may outweigh the consideration we have advanced. Closed circuits cannot be avoided entirely, but these should be omitted wherever possible, as each consumes power, results in wear and tear, and requires additional labor.

Flotation cells admit of improvement, and we believe that either more efficient fabrics will come into use that will require less attention in operation, or a type of flotation cell will be adopted that will avoid the use of fabric bottoms, which are now more or less troublesome owing to the use of calcium hydrate in the mill circuit.

Recoveries are now approaching a point where there is little sulphide copper mineral remaining in the tailing, and this is in a large measure included mineral that can be saved only by finer grinding. The greater proportion of copper in the tailing is in the form of oxidized minerals that are not susceptible of separation by flotation in any decisive way. The metallurgist who can discover a simple method for the recovery of oxidized copper minerals from the tailing product will achieve fame and money. Possibly the most promising line of research is in the development of new flotation agents that will react upon oxidized minerals. The discovery of xanthate indicates that there are unexplored fields that may yield to persistent effort. Sulphidizing has been tried, and although successful in the treatment of oxidized lead ores, its application to copper ores has given disappointing results. This recovery of oxidized copper minerals is thus the last major problem that remains to be solved in copper ore concentration.

Definitions

WHAT IS ore dressing? What is metallurgy; does it include ore dressing? And what is a mining engineer? The appearance of the new edition of Richards' "A Textbook of Ore Dressing," revised by Charles E. Locke and John L. Bray, again brings up this old subject, for on the first page we read that ore dressing is "the process of mechanically separating and saving valuable minerals from the valueless material of an ore, whereby the valuable minerals are concentrated into smaller bulk and weight by discarding some of the waste, or the process of mechanically separating two or more minerals, which combined have little value, into two or more products, each of increased value." This definition is substantially the same as that given by Professor Richards in the first edition of his book, twenty-two years ago. In its present form, it would be improved by saying "bulk *or* weight," rather than "bulk *and* weight," for in dressing asbestos ores, for instance, the asbestos has greater bulk after it has been separated from the gangue than before. Plainly, this definition of ore dressing includes all forms of concentration, and it also includes amalgamation, which might be considered on the border line; but not cyanidation or leaching. A former editor of this journal, A. W. Allen, drew the line more closely in his "Handbook of Ore Dressing," for he excluded all forms of concentration, though he did include roasting, which he deemed a preparatory treatment, or "dressing" of the ore, for a subsequent metallurgical process. In his introduction to the book mentioned, he devotes five pages to a discussion of the definition.

Definitions are, after all, largely empirical; like so many other things, they are founded on usage rather than sense, though it does no harm to give a thought to common sense occasionally where we have any choice in our use of terms. There seems, to us at least, no logical reason why the miner in the Tri-State district should call perfectly good ore "dirt," and call concen-

trate "ore;" or that Michigan copper ore should be referred to as "rock." And yet you will find these localisms used right along in these very columns, because they mean something to the most of the interested readers, whereas the more accurate term would be misleading, as, for example, if we should inform the Joplin miner that zinc ore was worth $3 a ton.

The common practice is, we believe, to include all sorting, crushing, grinding, classification, and all forms of mechanical concentration under the general term "ore dressing." This leaves amalgamation, cyanidation, leaching, smelting, refining, and electrolytic process to the realm of "metallurgy," whether pyro, hydro, or electro. We do not speak, however, of an ore dresser, though sometimes we call him a millman. One skilled in ore dressing is perhaps best classified as a metallurgist. "Mining engineering" and "mining engineer" may well be accepted as general terms covering mining, ore dressing, and metallurgy, though in the chartered names of mining societies a tendency has developed to separate the classifications of mining and metallurgical engineering.

Judicial Common Sense

FEDERAL JUDGE George M. Bourquin of Montana is an official who has, on more than one occasion, resolved intricate legal questions with the application of common sense. Recently in charging the jury in the case of the United States against Gordon Campbell, oil operator, accused of fraud in raising funds for an oil-operating syndicate, the judge set forth sundry propositions that strike the layman, unversed in law, as being eminently sensible, no matter how the higher courts may view them. From reports it appears that a "common law trust" was organized, with Campbell as manager, to go into the oil business. The public was appealed to for funds, published advertisements informing the putative investor that 25,000 units were to be sold at $10 per unit, thereby implying that a working capital of $250,000 would be available for operations when the total was subscribed. It appears, however, that one Bloomhuff, who undertook to market the units, arranged with Campbell that he should receive 50 per cent of such money as he obtained from purchasers. In charging the jury Judge Bourquin said of the defendant Campbell:

> "He was not entitled to take that money and spend it for the purpose of inducing others to come in. He had no right to pay one dollar in commissions, or for advertising, to pay for expenses or to mail letters, or anything of that sort, because a promoter or manager, the same as in a corporation, who negotiates to undertake to get together joint adventurers of that sort, to that extent is in the nature of a trustee. That is, a man must deal honestly with the others, and it is his duty to gather the money together at his own expense. . . . If he could spend half, he could spend all; so the enterprise would be broke the moment he has got in the 25,000 investors. So by that you can see that the law is only common sense. In this case, this money was taken out to pay commissions, to pay for advertising, mailing and expenses of that sort; that was misappropriation. That was never made known to the joint adventurers. They were told, to all intents and purposes, by this advertising that when all the units were sold, there would be a capital of $250,000 to operate with. There was nothing of the sort."

This reasoning apparently impressed the jury, for Campbell was found guilty. The essence of the judge's statement, it seems to us, lies in the sentence, "That was never made known to the joint adventurers." If the salesman had told each purchaser that 50 per cent or more of what he paid was to go to defray the expenses of selling the units and that only 50 per cent or less was to go into the fund that would be accumulated for actual oil operations, there would have been no crime committed. As long as the man who contributes actual money knows what is going to become of it he has no ground for complaint. Taking advantage of the ignorance or bad judgment or foolishness of another person does not constitute crime, though it may be morally wrong.

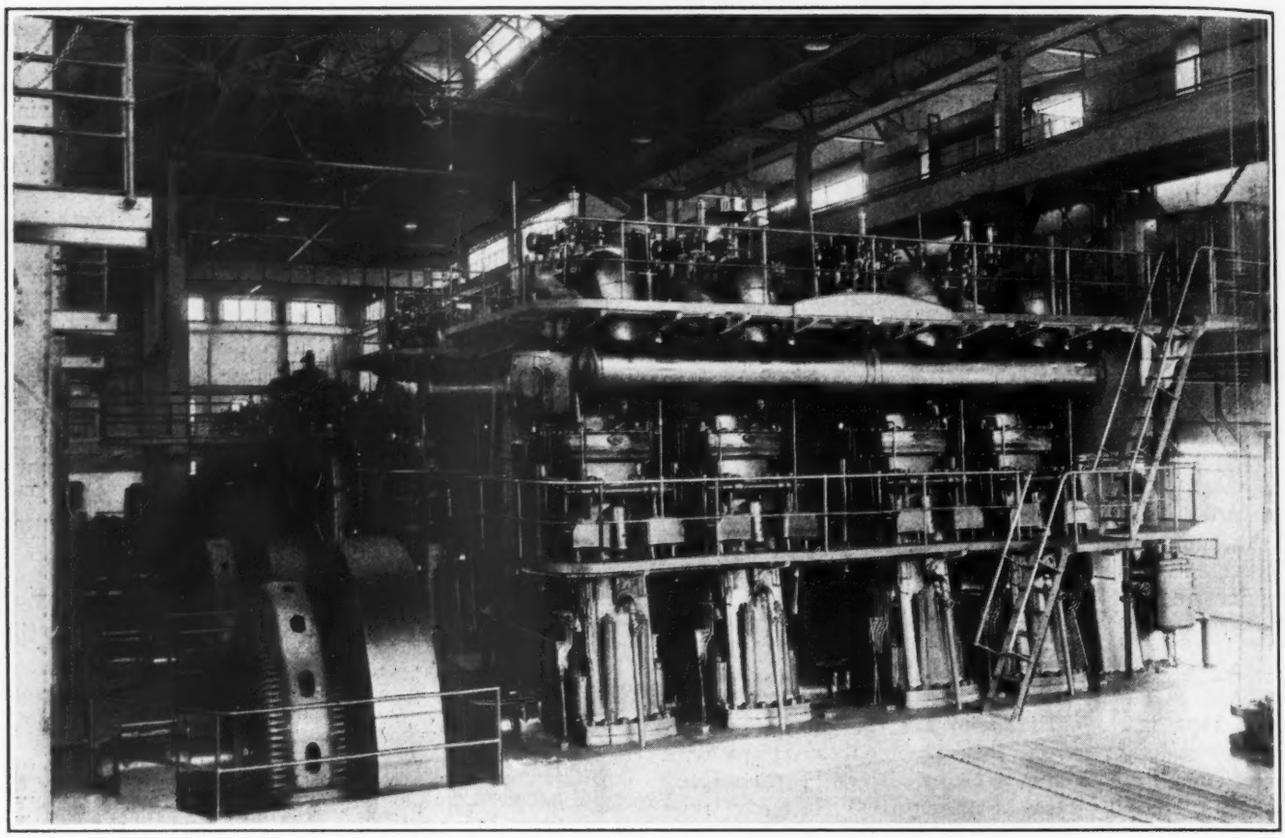
If a mining stock promoter should offer shares for sale with the plain statement that 80 per cent of the proceeds was to go into his own pocket as a commission, and that the remaining 20 per cent would be spent digging for gold beneath a vacant lot on lower Broadway, his stock-selling operations would be legitimate. Of course, he probably would not get the money. The point is that unless there is actual misrepresentation there can be no swindling.

If Judge Bourquin's construction of the law is sustained, the methods of a host of oil promoters out West necessarily will be materially revised. Apparently, Campbell's operations were not unique.

Making Government Maps Popular

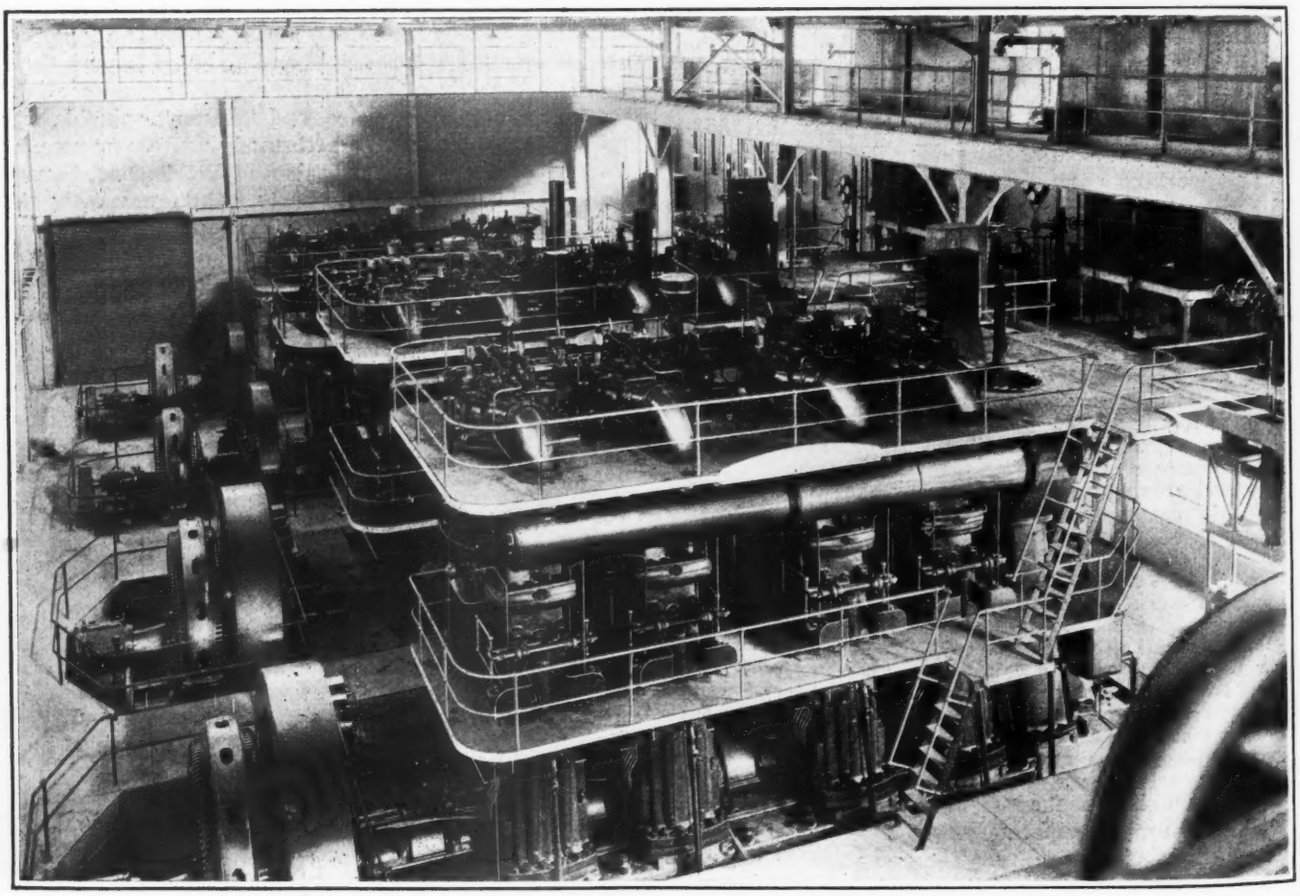
THE UNITED STATES GOVERNMENT is the greatest publisher in the world and the Government Printing Office at Washington is the biggest printing plant. Much of what is published is of little moment and might better have been left in manuscript form or not have been written at all, but a large amount of valuable information is published, both of scientific and popular interest. Government books and bulletins are, of course, not advertised and no effort to push their sale is ordinarily made, for the reason that no one gets any profit out of doing so, and the most valuable and interesting publication, whether of scientific or popular interest, often receives only limited distribution, though it is obtainable for a few cents. But apparently the Department of the Interior is making an effort to popularize the Geological Survey's topographic maps, judging from two press bulletins we have just received. One is entitled "Back to the Starting Point. New Government Map in Maine Lake Region Shows Forty-Mile Canoe 'Bow' Trip With Less Than Two Miles Portage." The bulletin goes on to describe the new map of the Attean quadrangle in a most interesting manner, bringing in the proposed canoe trip suggested in the head. A similar, though different, story is told about a new map of the Belmont quadrangle, in Allegany County, New York.

The Survey's "mile-to-the-inch" topographic maps may well be brought to the attention of the public, as they are excellent pieces of work. Nowadays, when so many of us travel over the country on rubber tires, they are of considerably increased utility. These maps are now overprinted in colors, with the principal highways indicated by red lines and distances to important road junctions and cities shown in the margins. This is a good idea, for one of the motorist's troubles, in using these maps, has been that the worst trail looked on paper like the finest concrete highway. The newer editions of these maps will prove a great aid to the motorists, for in many respects they are immensely superior to the ordinary road map.



The largest Diesel engine installation in the Western Hemisphere

It is owned by the Phelps Dodge Corporation and supplies power at the Nacozari Branch, in Sonora, Mexico
The plant was erected in 1922 and develops 9,000 hp. at full load.



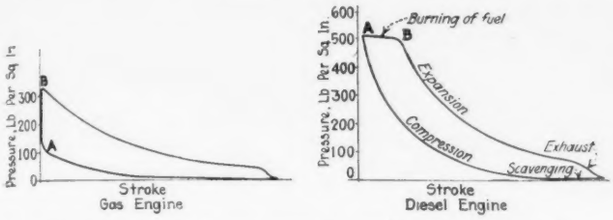
Another Phelps-Dodge Diesel plant

Power generated by this unit at Bisbee, Ariz., drives the new concentrator and furnishes power for some of the mining operations of the company. The two machines in the foreground have a rating of 2,000 hp. each; the two in the background are rate at 1,250 hp. (sea level rating).

The Diesel Engine in the Mining Field

By Felix Edgar Wormser
Mining Engineer, New York City

DIESEL ENGINES are the most efficient prime movers known today. They convert more heat energy of fuel into power than any other engine. Only a few years ago use of the Diesel engine in the mining field was rare, but its introduction has proved so successful that now about one hundred and fifty thousand horsepower is delivered every day by Diesel engine power plants in North America.[1] In fact, mining has played a conspicuous part in the general development and use of the American-built Diesel engine. Today, the largest Diesel installation in the Western Hemisphere is at the Nacozari Branch of the Phelps Dodge Corporation in Mexico. It develops 9,000 hp. at full load. In nearly every state in the Union where mining is conducted, Diesel engines, or engines working on a modified Diesel principle, will be found. Gradual growth in the use of the Diesel—which has not been confined to mining alone—is based upon many points of superiority of the Diesel engine over competitive forms of prime movers, chiefly steam and gas engines, and upon the manner in which the Diesel engine has solved the power problems peculiar to the mining industries in isolated places.



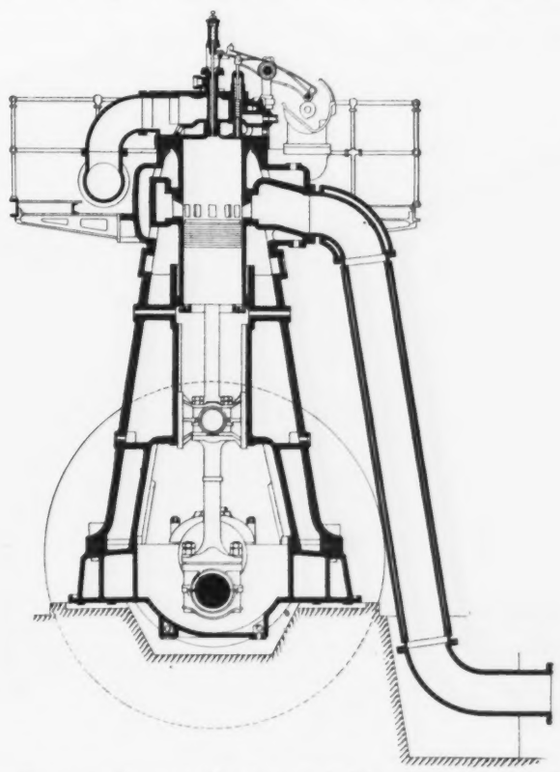
Comparison of gas engine and Diesel engine indicator cards

The cycle to the left shows the effect of explosion of the gaseous fuel used. This is known as a constant volume type of prime mover. At the right, the Diesel card shows a burning of the fuel without increased pressure. Hence this engine is known as a constant pressure type.

At the risk of becoming elementary, I shall take up first the principles upon which the Diesel engine works, the variations in the design of numerous American types and, finally, examples of Diesel engine plants in the mining field with the work that they have done and are doing.

What is a Diesel engine and wherein does it differ from the so-called semi-Diesel, solid-injection Diesel and the gasoline engine? The constructional differences between these types are not great, but they are extremely important so far as operating economies are concerned. Unlike the ordinary gas engine, the Diesel uses a much higher compression—so high, in fact, that when liquid fuel is injected into the cylinder at the end of the stroke, the heat of compression (about 1,000 deg. F.) is sufficient easily to ignite the charge. No electrical ignition system is required. The gas engine, it will be recalled, draws its fuel mixed with air into the cylinder and compresses it. Then a spark ignites the mixture of gas and air, causing an explosion, the force of which is used to move the piston. In the Diesel machine no explosion takes place—rather a rapid burning that continues while fuel is injected and the piston is moving outward. The difference between the two types is well brought out by the two diagrams of Fig. 1, which are ideal indicator cards. In these diagrams the significant portion to observe is the line *AB*, which represents that part of the cycle in which fuel is burned in the cylinder. The gas engine line *AB* is almost vertical, owing to the explosion that occurs when the gas is fired; the Diesel engine line is flat, because the fuel is burned at steady pressure. This striking dissimilarity in operating characteristics has caused the gas engine to be termed a constant-volume type of prime mover, whereas the Diesel is a constant-pressure type, terms that indicate, quite appropriately, the differences under which combustion of the fuel occurs, differences that will be apparent after a brief study of the diagram.

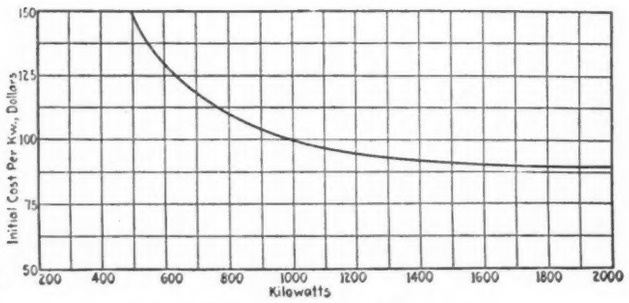
Inasmuch as the Diesel engine injects fuel at high pressures—1,000 lb. per square inch—an air compressor is needed to supply air to inject the fuel into the cylinder. It also furnishes a small part of the necessary air to burn the fuel. The compressor is usually built integrally with the Diesel engine and compresses air in three stages to 900 or 1,000 lb.—much higher than the compression pressure. Semi-Diesel and some



Cross-section of the type of Diesel engine used in the Phelps Dodge Corporation's power plants

This is a two-cycle engine of the crosshead-piston construction. Scavenging air is admitted through valves in the cylinder head. These engines are built by Nordberg Manufacturing Co.

[1] A survey by *Power* indicates total of 785,000 hp. developed by Diesel engines in all plants and uses.

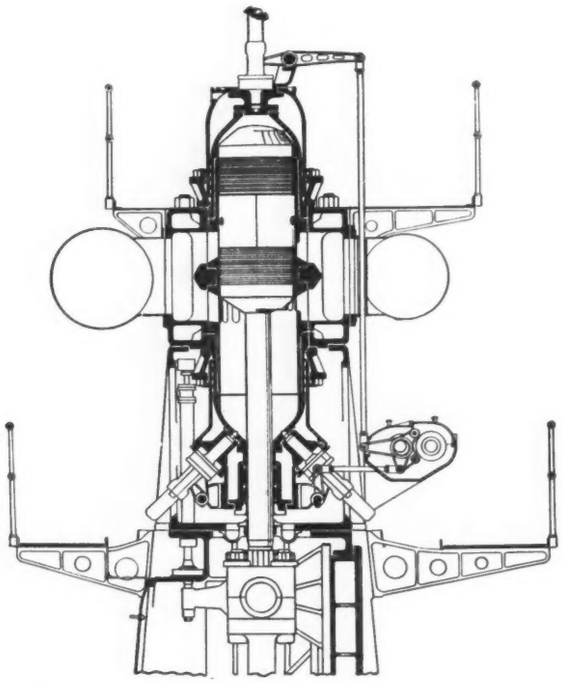


Cost of Diesel engine plants installed

This curve has been prepared to show the cost of engines delivering upward of 500 kw. installed with all accessories

solid-injection engines do not use as high compression as the Diesel and may rely for proper ignition upon the heat retained in an uncooled portion of the cylinder—sometimes a hot-bulb. Many solid-injection engines, however, use a Diesel compression pressure of 450 lb. and include such designs as the Fairbanks Morse, Worthington, Foos, Bessemer, and others. Low-pressure, solid-injection engines, such as the Ingersoll-Rand, operate under the Price patents. Fuel is injected without air pressure in this type of engine. It is not quite so efficient a machine as the Diesel, but is less expensive to build, because it generally does not need an auxiliary air compressor. The solid-injection Diesel will be discussed in greater detail a little further on.

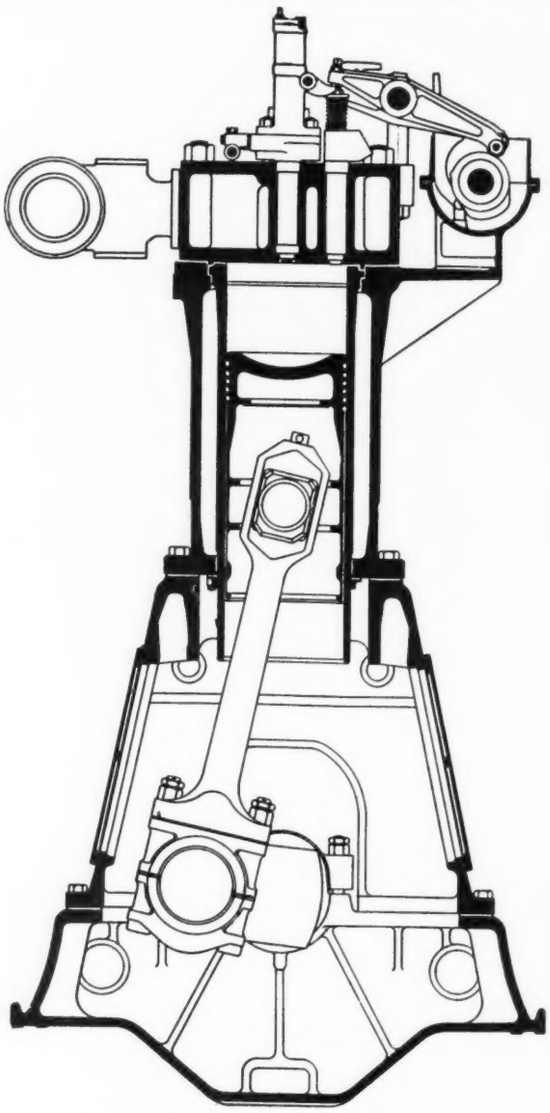
The Diesel engine converts more heat energy of a fuel into power than any other commercially manufactured prime mover. Its thermal efficiency ranges from about 32 to 35.3 per cent, compared with an average of 12 per cent for a condensing steam plant. The table on page 127 gives a comparison of the thermal efficiencies of various types of engines and shows the Diesel well in the lead.



One of the latest developments in American Diesel engine practice

A double-acting two-cycle Diesel engine built and designed by Worthington Pump & Machinery Corporation

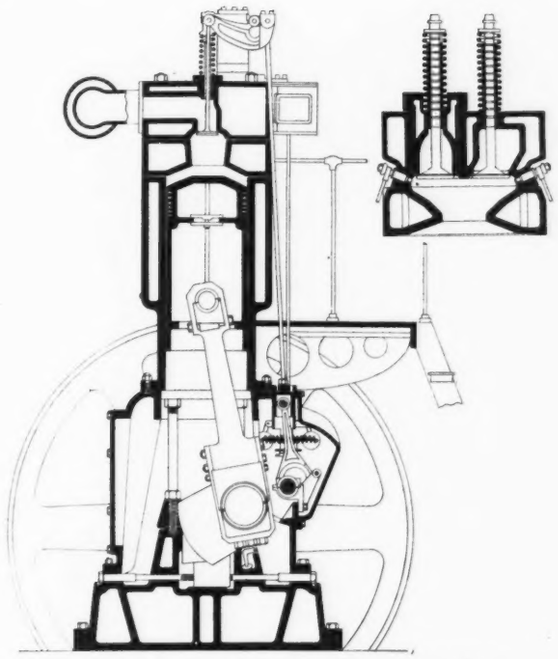
Owing to its heavier construction and the need of an auxiliary air compressor, the Diesel engine is more expensive to build than the gas engine, but the advantage lost in first cost is more than compensated by its many advantages. Low-grade petroleum, formerly thought impracticable for internal-combustion engines, is used as fuel by the Diesel. It doesn't seem possible



A four-cycle Diesel engine

Fuel injection, inlet and exhaust valves are all located in the cylinder head. This particular engine has a trunk piston and is built by Busch Sulzer Bros. Diesel Engine Co.

that some of the heavy, pitchy looking oils burned by numerous Diesel plants can be utilized by any internal-combustion engine, but it can and does use low-grade oils varying all the way from kerosene to coal tar. Fuel economy is marked for both large and small-sized Diesel plants. In this respect the Diesel plant is different from the steam plant which is most economical in very large units. In comparing Diesel engines and steam turbines or reciprocating steam engines, the fact must not be ignored that the comparison is not complete unless the boiler and accessories are included in the steam unit. Thermal efficiency of the Diesel is only slightly lower at fractional loads than at full load, a characteristic that the steam engine does not possess. Then again, the Diesel plant is completely self-con-



A four-cycle solid-injection oil engine

It works at low compression pressures. Note the two fuel-injection valves (upper right-hand corner) and the shape of the combustion chamber. This engine is built under the Price patents and is a comparatively recent development of solid injection practice. Ingersoll-Rand manufacture this especial type

Heat Consumption and Thermal Efficiencies of Different Types of Prime Movers at Continuous Full Load

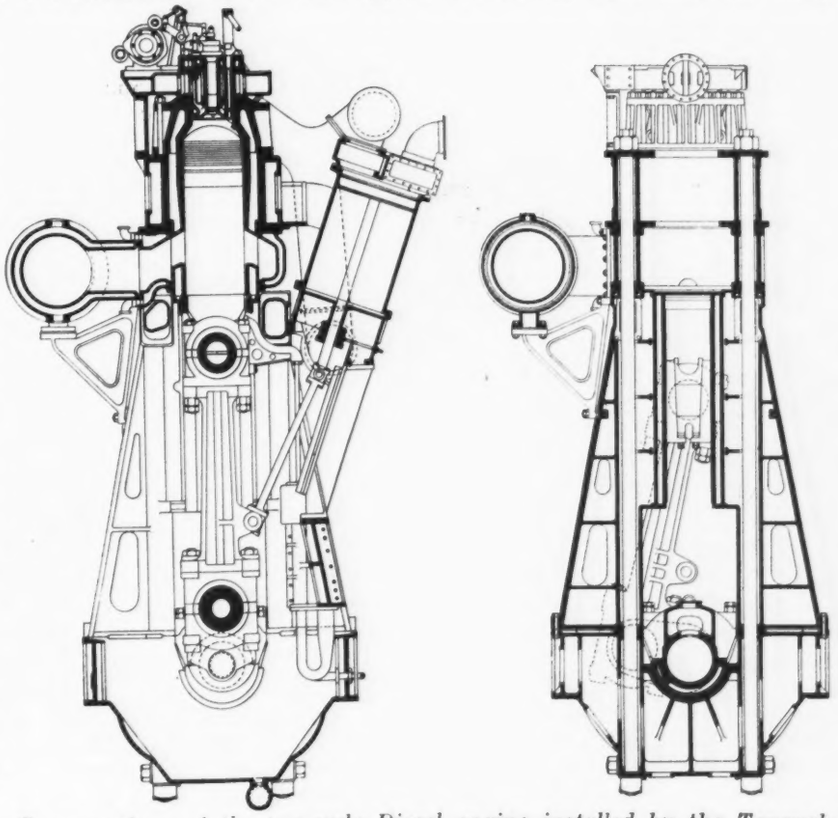
Type of Prime Mover	Heat Consumption per B.hp. B.t.u.	Over-all Thermal Efficiency	Superiority of Diesel Engine *a*
Non-condensing steam engine *b*	40,000-28,000	6.30- 9.1	5.6 -3.6
Condensing steam engine using superheated steam	28,000-16,500	9.1- 15.4	3.6 -2.3
Locomobile engine with superheated steam and reheater, condensing	17,000-15,200	14.9 -16.7	2.4 -2.1
Steam turbine, superheated steam, 200 to 2,000 hp. *b*	24,000-15,500	10.6 -16.2	3.2 -2.2
Steam turbine, superheated steam, 2,000 to 10,000 hp. *b*	15,500-14,000	16.2 -18.1	2.2 -1.9
Gas engine without producer	10,400- 9,300	24.4 -27.5	1.33-1.28
Suction gas engine *c*	14,000-11,200	18.1 -22.7	1.95-1.55
Diesel engine *d*	8,000- 7,200	32 -35.3	.....

a Figures in this column are to be used as factors with which to multiply values in preceding column.
b Figures include boiler losses.
c Figures include producer losses.
d Haas, Herbert, The Diesel Engine, Bulletin 156, Bureau of Mines.

tained, requires a much smaller amount of speed than the steam-turbine plant, approximately half as much, and does away with the ash-disposal and fuel-storage problems always troubling a steam unit. Furthermore, it is easier to take care of the operation of a Diesel engine than that of a steam engine. The Diesel engine can be started quickly and in about two minutes be brought up to full load. It does not consume any fuel when idle. When properly designed and operated, it is as reliable as any other prime mover. Against these manifold advantages one must, in all fairness, place the occasional higher initial cost per horsepower of the Diesel and its generally greater lubricating cost. Progress is steadily being made, however, to decrease the cost of the Diesel engine by lowering its weight and increasing the power per cylinder. It is gradually being made larger and larger in size. Diesel engines are in use today of a much larger size than was thought practical a few years ago. In fact, the Diesel nowadays costs no more than a high-grade steam plant.

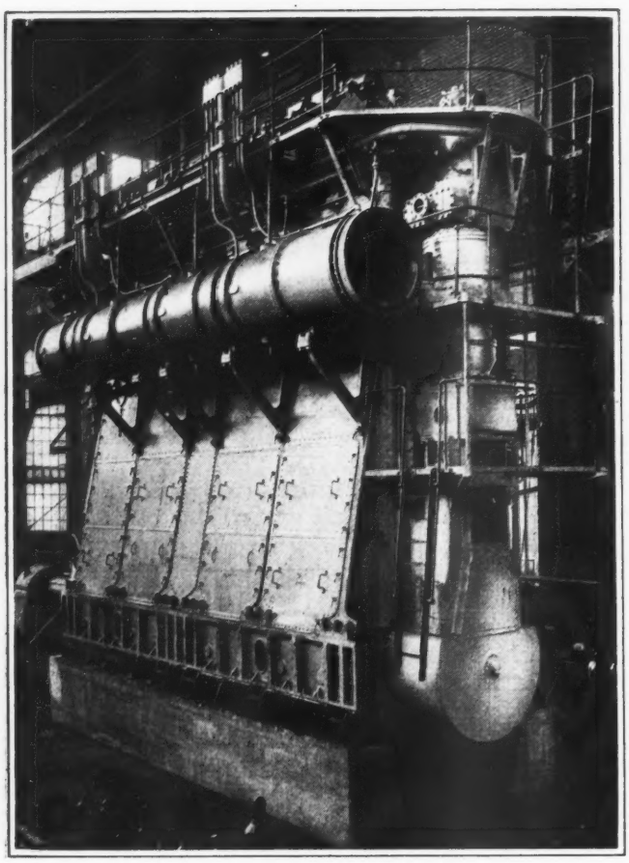
Some of the efforts now being made to reduce the cost of the Diesel engine center on raising the mean effective pressure in the cylinders, supercharging, or increasing the weight of air in the cylinder and hence the quantity of fuel that can be burned, as well as modifying the shape of combustion chambers and the position of the sprayers. Another important step has been to make them double acting. (See illustration on p. 126. Diesel engines are built on both the two-cycle and four-cycle principle. Theoretically, the two-cycle machine should be twice as powerful as the four-cycle, because it has twice as many power strokes per revolution. However, owing to the fact that the two-cycle Diesel machine uncovers its exhaust ports at about 80 per cent of its stroke, some of the energy still behind the piston when that point is reached is dissipated. The two-cycle machine does away with exhaust valve gearing, but requires a scavenging pump to compress air at low pressure to sweep the spent gases out of the cylinders when the piston uncovers the exhaust ports.

One of the latest developments in American Diesel engine practice has been to build a double-acting machine. This type of Diesel has been built for many



Cross-sections of the two-cycle Diesel engine installed by the Tonopah Extension Mining Co. (see following page)

The section through the cylinder shows the relation of the scavenging pump to the main cylinders. A crosshead is used with each piston. The section on the right shows the tie rods that keep the A frame in compression. Design by the Bethlehem Steel Co.



One of the Diesel engines shipped to the new power house of Tonopah Extension Mining Co., Tonopah, Nev.

This is a compact four-cylinder machine capable of delivering 2,000 hp. at full load. Note the air compressor at the end of the engine. See drawings on page 127

years abroad, but only lately has it been taken up by American manufacturers. Recently the Worthington Pump & Machinery Co. placed such a type on the market. The problem of building the engine so that parts of it will not be injured by the great amount of heat generated in the double-acting type has been difficult.

Reduction in the first cost of Diesel engines will have the important consequence of widening its field of use, because the first cost of the Diesel in comparison with the steam turbine has stood in the way of its wider adoption in large installations.

Although the explosion type of gas engine is cheaper in first cost, it uses more and costlier fuel and lubricating oil than the Diesel and does not have so high an efficiency, either at full or fractional loads.

The most important element in the cost of power generated by any heat engine is the cost of the fuel; the second item is the fixed charge or interest on the investment, which does not vary with the load on the plant. Where the load factor is high, the Diesel can compete readily with steam, but where the load factor is low, the turbine, with a lower initial cost, has the better chance. For large plants careful comparison of the two kinds of power is needed, with the Diesel being preferred more and more.

Are Diesel engines meeting with favor in the mining field? Decidedly, yes. They are used in all sizes, from small one-cylinder or two-cylinder machines to the huge multi-cylinder machines that have made such a splendid record in the Southwest. They are used in both metal and non-metallic mining operations. Gold, silver, copper, iron, gypsum, phosphates, fuller's earth, garnet, and other minerals are being mined today with power generated by Diesel plants both in cold and in hot climes, and wherever used they have given great satisfaction. Doubtless a contributing factor to the growing use of the Diesel engine in the last few years has been the low price of crude petroleum. There was a time, shortly before the flush production from the California oil fields, when doubt arose as to the future of oil prices. Crude petroleum was so expensive that one large copper producer in the Southwest took steps to find out the practicability of using pulverized coal for fuel rather than oil under his boilers. However, the great outpouring of oil from the Los Angeles district completely changed the outlook and has helped to popularize the Diesel engine.

Diesel Installations in the Field

Probably the very first large Diesel engine plant used in connection with a mining operation in the United States was erected by the International Agricultural Corporation at Mulberry, Fla., to generate power for phosphate-mining operations. The first unit of this plant was built in 1906. Six more units were added in 1907 and an eighth in 1910. They are all of 450 b.hp. each and were supplied by the Busch Sulzer Bros. Diesel Engine Co. This plant is still doing duty after eighteen years' service.

One company has done more than any other to introduce the use of the Diesel engine in the mining field. This company, the Phelps Dodge Corporation, now generates at five of its branches in the Southwest a total of 31,000 hp. at full load with twenty-four Diesel engines. These installations are by far the largest in the mining field—in fact, the unit at Nacozari, Mexico, built in 1923, is the largest Diesel engine plant in the Western Hemisphere. Although engineers of the Phelps Dodge Corporation had watched the development of the Diesel engine from the time it was first built in Europe, it was not until December, 1914, at Burro Mountain, N. M., that the first large Diesel engine was placed in operation.[3] It was of European make—Carels Frères of Belgium—and was of 1,000 hp. Two of them were ordered and erected, the second

[3]Charles Legrand, of the Phelps Dodge Corporation, wrote a paper descriptive of this plant for the *Transactions* of the A.I.M.E. Vol. 60, p. 208.

Power plant of Tonopah Extension Mining Co. It will house two 2,000-hp. Diesel engines

Waste-heat steam-generating annex at the side of the Tonopah Extension Mining Co.'s power plant

in 1915. Oddly enough, they have five cylinders, the reason being, that, although a four-cylinder machine was originally ordered, the manufacturer requested permission to add another cylinder to be sure the engine would come up to power expectations with regard to peak load and fuel economy at the altitude of Burro Mountain, 6,000 ft. The company discovered later that this extra cylinder was unnecessary but a five-cylinder machine has become standard in some of the company's other plants. All subsequently erected Diesel engines were built by the Nordberg Manufacturing Co., which acquired the right to manufacture the Carels type machine in the United States.

The Burro Mountain Diesel installation and all the other Phelps Dodge Diesel units are of the two-cycle type. They give a little more latitude in the kind of fuel used than the four-cycle machine, as a high-sulphur content is not so unobjectionable. Moreover, it permits some compensation to be made for the loss in power at the high altitude at which these Diesel engines are operated. This is done by increasing slightly the pressure in the cylinder at the beginning of the stroke with the scavenging-pump air supply.

Phelps Dodge Diesel Engine Installations

Location	Number of Engines	Horsepower of Eacn *b*	Number of Cyl.	Units Driven
Burro Mountain, New Mex.....	3	1,250	5	850-kw. generators *a*
	2	750	3	3,700-cu.ft., 95-lb. air compressors
Morenci, Ariz...	4	1,250	5	850-kw. generators
	1	1,250	..	6,400-cu.ft., 100-lb. air compressor
Globe, Ariz.....	2	1,250	5	850-kw. generator *a*
Bisbee, Ariz.....	2	2,000	4	1,500-kw. generator *a*
	2	1,250	5	850-kw. generator *a*
Nacozari, Mex..	2	2,000	4	1,500-kw. generator *a*
	4	1,250	5	650-kw. generator *a*
	2 *c*	750	..	4,000-cu.ft. 95-lb air compressors

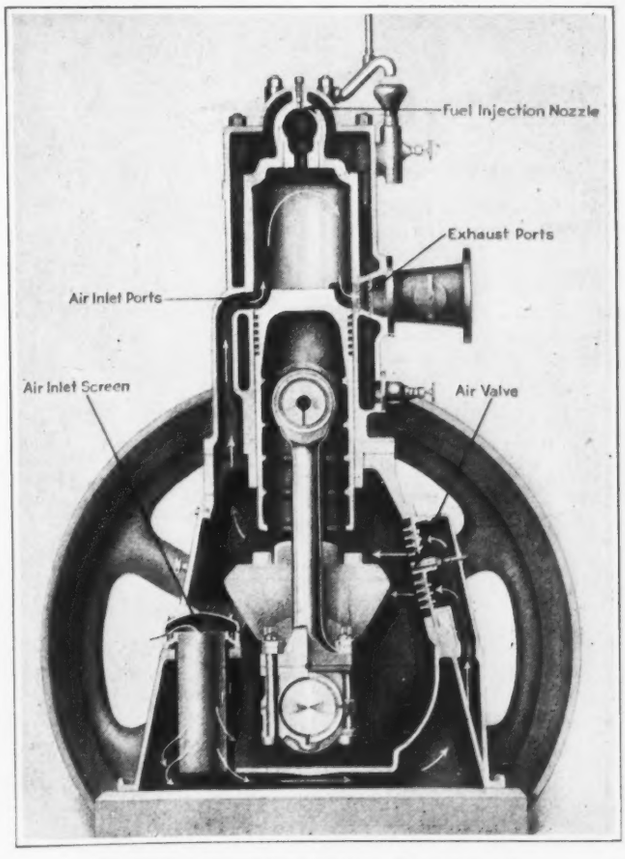
A total of twenty-four engines capable of generating 31,000 hp.
a Sixty-cycle, three-phase
b Sea level ratings
c At Pilares, six miles from Nacozari

Naturally, this increases the work of the scavenging pump and fuel consumption, but decreases the investment per horsepower. The construction of this type of Diesel engine is shown in the illustration on p. 125. Each engine is a complete unit by itself.

Power actually delivered by these engines is slightly lower than indicated in the table, owing to the elevation at which the machines work. It will be noted that some of the units consist of machines with 250 hp. per cylinder; others have a rating of 500 hp. per cylinder. The former type has cylinders of 20¾-in. bore and 26-in. stroke; the latter 28-in. bore and 44-in. stroke. They run at 180 and 120 r.p.m. respectively. All the engines have vertical cylinders. Crossheads, instead of trunk pistons, as in the automobile type of gas engine, are used. A continuous oiling system with the usual filtering apparatus and circulating pumps are provided. Cooling water is furnished cylinder, piston, crosshead-slides, head and part of the exhaust pipe above the floor. Four valves admit the scavenging air quickly to the cylinder.

Fuel oil is fed to the cylinders and injected into them by high-pressure air. Governing the speed of the engine is accomplished by regulating the amount of fuel delivered to the cylinders. The Diesels are started by compressed-air released from air bottles. A special easily burned starting oil, 24 deg. Beaumé, is used. The regular fuel oil is heated with hot water from the cooling system. Both Californian and Mexican oils of 14 deg. Bé. are burned. As much as 4½ per cent sulphur is contained in the Mexican oil, which is troublesome in increasing the difficulty of proper lubrication and the maintenance of cylinders and pistons. Exhaust gases are consequently corrosive and harmful to the buildings and steel-work with which they come in contact.

According to Mr. Legrand, the fuel consumption of these engines is good; under test the 1,250-hp. type delivers one kilowatt-hour at the switchboard for an average of 0.69 lb. fuel oil at loads between 600 and 700 kw. The 2,000-hp. type consumes 0.66 lb. of fuel oil for each kilowatt-hour generated between 1,200 and



A two-cycle solid-injection Diesel engine

This type is built in small and moderate sizes and is popular with the fair-sized prospecting and mining operations. No air compressor or scavenging pump is required. Note the bulb-like combustion chamber. The engine is designed by Fairbanks Morse Co.

1,500 kw. Under average running conditions of a plant these figures are 3 to 8 per cent higher. From 2 to 5 per cent of the power generated is needed to operate the auxiliary air compressors, pumps, and lighting.

The Phelps Dodge Corporation has been very liberal in making public the operating cost of its Diesel plants. The average detail costs on its three Arizona Diesel plants, at which operating conditions and labor costs are very much the same, are given below:

Phelps Dodge Corporation's Average Power Plant Costs for 1924 for Its Arizona Diesel Plants—Electric

DETAIL ELECTRIC COSTS

	Cents Kw.-Hr. Available
Operating labor	0.0887
Engine repairs	.1193
Other repairs	.0107
Lubricating oil	.0177
Water	.0157
Other supplies	.0063
Fuel oil	.541
Miscellaneous	.033
Total	0.8324

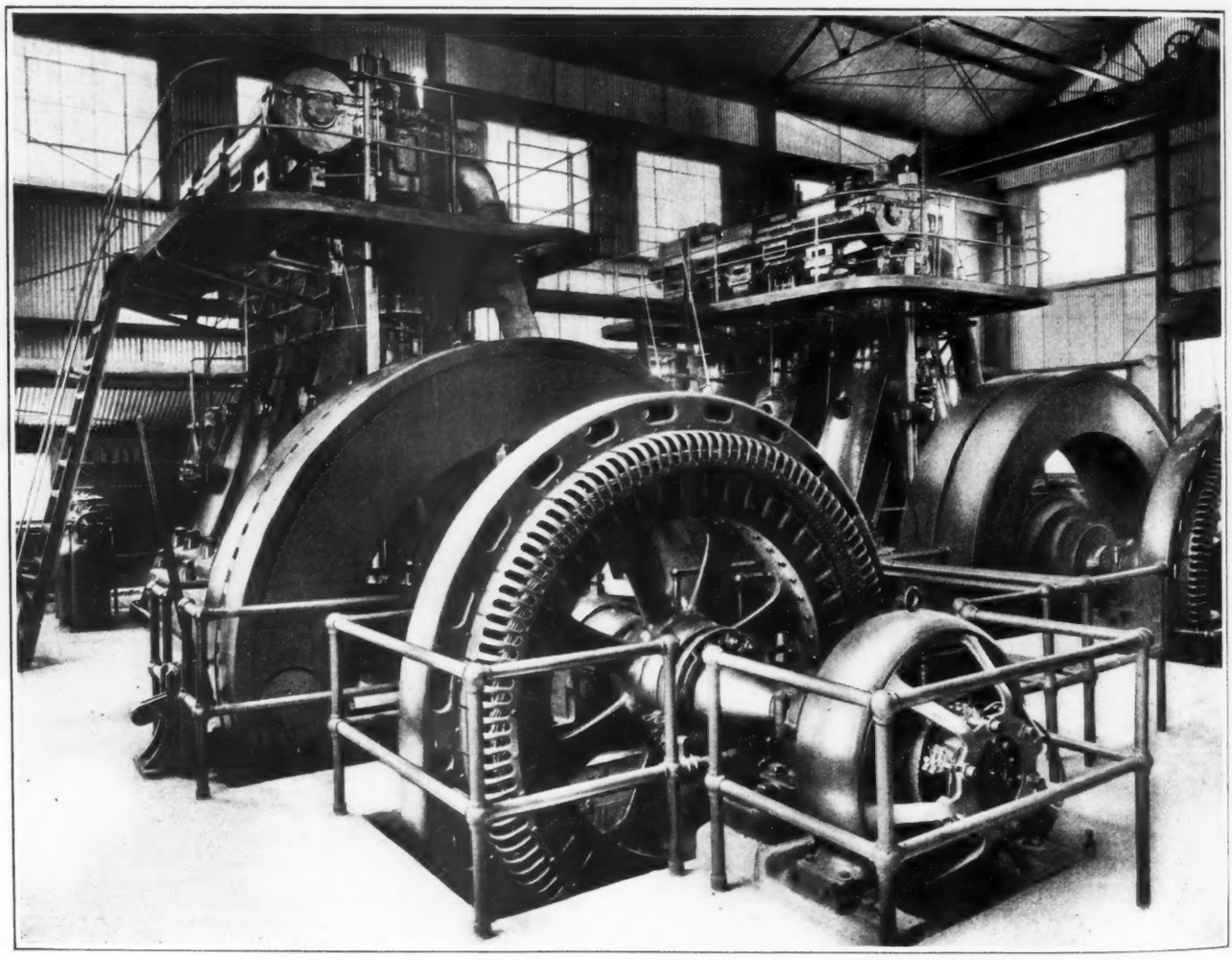
Average load factor, 91.76 per cent.

Note—Average load factor is based on 700 kw. as 100 per cent or full load on Type 5 E.G. engines, and 1,300 kw. as 100 per cent or full load on Type 4 F.H. engines.

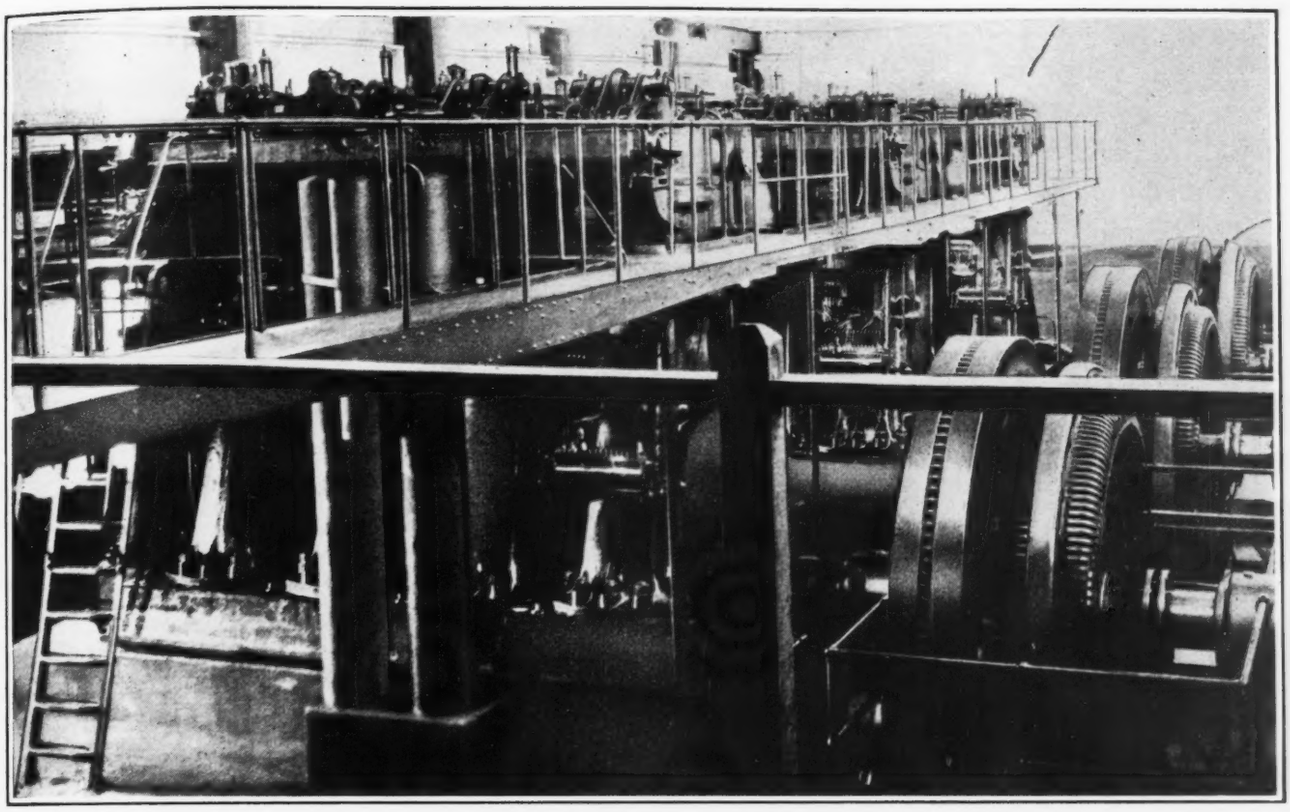
Load factor is figured on basis of engines actually running, and not on total engines installed.

These figures do not include taxes or general overhead. The costs are very low.

A much smaller but nevertheless highly efficient Diesel engine power plant was built in 1923 by the Iron Mountain Co. at Iron Mountain, Mo., to furnish electric power for the operations of the company. This plant contains two Diesel engines of 520 hp. each built by the Fulton Iron Works. They are three-cylinder machines direct connected to 350-kw. a.c. generators. The power plant has been frequently overloaded and was subjected to constant operation from the time of erection to the fall of 1924, when the mine was shut down. This installation has solved the power problem at Iron Mountain in a very satisfactory manner. Iron Mountain is not close enough to a coal field to obtain cheap fuel; there is no hydro-electric power line near the mine which can be tapped without great cost, and no waterpower is available. The mine is located almost directly on the main line of the Missouri Pacific R.R., however, and can draw petroleum readily from the Southern field at low cost. After a careful investigation it was decided to install a Diesel engine power plant. Subsequent performance of the engines thoroughly justified the decision that was made. Each Diesel engine at Iron Mountain is of the four-cycle type, operating at moderate speed—164 r.p.m. An extra-heavy flywheel, weighing 43 tons, helps maintain an even torque. From no load to full load the machine will show about 2 per cent variation in speed. Cylinders have a 22-in. bore and a 29½-in. stroke. The



Power plant of the Iron Mountain Co., Iron Mountain, Mo. It contains two 520-hp. three-cylinder Diesel engines, each driving an alternator



Kennecott's Diesel power plant. It consists of three 500-hp. engines. The plant is located at Latouche, Alaska

main shaft is 13 in. in diameter and has 22-in. bearings. A 24- to 26-deg. Bé. fuel oil from Louisiana was used when I visited the plant last fall, and gave about 11 kw. for each gallon consumed. Lubrication of the cylinders requires about 1½ gal. of cylinder oil per day, while crank and bearings use 2 gal. Fuel oil is injected into the cylinders at 600 to 950 lb. pressure. Compressed air is furnished by a three-stage air compressor built integrally with the engine. Total cost of generating power with these Diesel engines amounts to slightly less than 1c. per kilowatt-hour. As shown in an accompanying photograph of the entire surface plant of the Iron Mountain Co. (p. 130), the power plant is very compact.

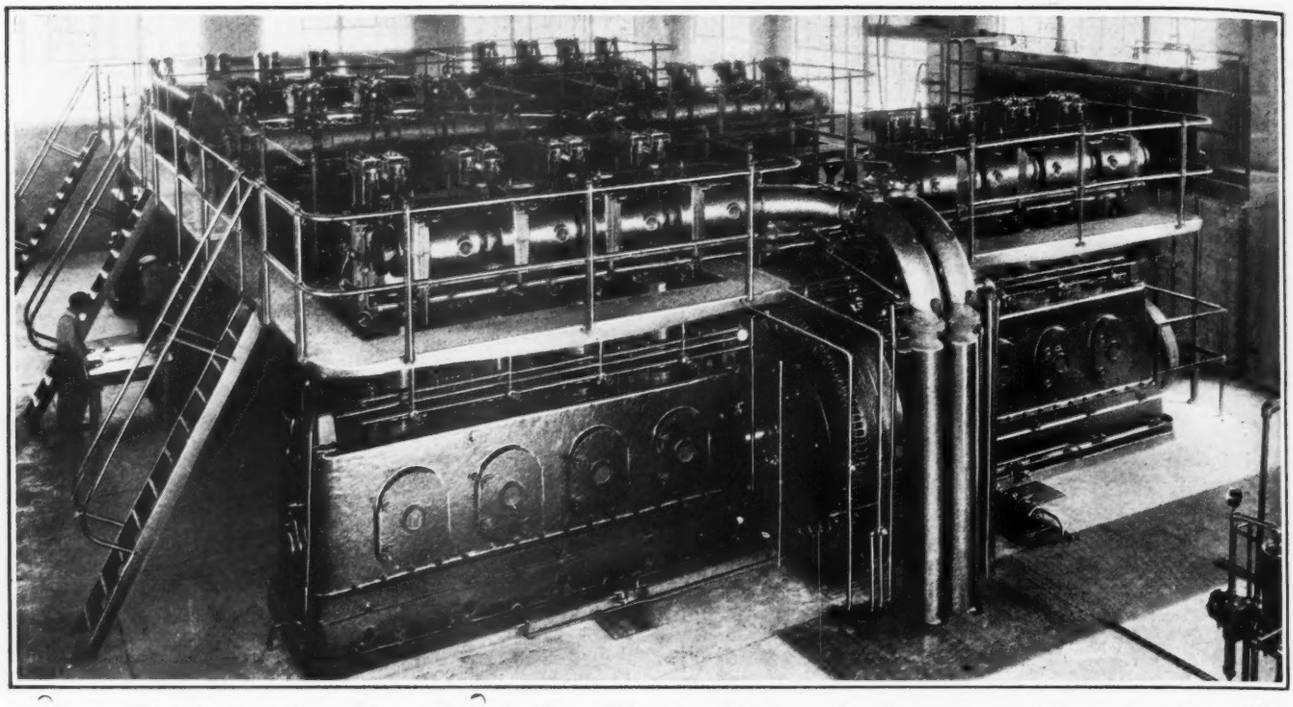
An unusually interesting Diesel engine installation is now being built at the property of the Tonopah Extension Mining Co. in Tonopah, Nev. Not only are Diesel engines being installed because of their high efficiency but because these engines can be used in connection with the cyanide operations of the company. It is necessary in the cyanide process of Tonopah Extension to raise the temperature of each agitator charge to 115 deg. F. to obtain the maximum recovery of gold and silver. At present this is done by steam from boilers heated by fuel oil. The company now intends to use the waste heat from the exhaust of the Diesel engines by passing the hot gases through vertical tubular boilers, one boiler being connected to the exhaust from each engine. Diesel engines are occasionally used for heating steam in boilers. The Kennecott Copper Corporation has a Diesel plant using waste heat from the engines for such a purpose.

A spacious and well-lighted building of steel and brick houses the Diesel engines at Tonopah, as indicated in an accompanying photograph (p. 128). It is 57 ft. wide, 121 ft. long and 42 ft. high, and when completely equipped in the fall of 1925 will house two Diesel engines of 2,000 hp. each. The machines are of the two-cycle type and are built by the Bethlehem Steel Co. They are slow-speed, long-stroke Diesels. Each has four cylinders, 25½-in. bore with 48-in. stroke, each cylinder being rated at 500 hp. at sea level. The engines are direct connected to three-phase, sixty-cycle, 6,600-volt generators. Speed of the engine is 116 r.p.m.

An interesting feature of the construction of the Bethlehem Diesel engine is the manner in which the frame is built. By means of six long, vertical tie rods the top of the cylinder is rigidly bolted to the bed plate. When the engine is erected, these tie rods are given a tension, by bolting, about 25 per cent greater than the maximum tension arising from the combustion of the fuel in the cylinder. This results in keeping the A frames always in compression and never in tension. Inasmuch as the A frames are made of cast iron, which is weakest in tension, this feature makes for a lighter weight A frame. The scavenging system of this engine also differs from other types of Diesel engines in that the scavenging pump is built at an angle (see illustration on p. 127) to the vertical axis of the engine, and uses an aluminum cylinder.

Waste heat from the exhaust of a Diesel may also be used to generate low-pressure steam, as stated before. The Latouche Diesel power plant of the Kennecott Copper Corporation in Alaska generates steam at 8 lb. pressure in a low-pressure boiler by exhaust gases. About 20 per cent of the heat of the oil is used for that purpose. Incidentally, this power plant is the largest oil installation in Alaska, although only one of many that are found in the territory.

Kennecott started using Diesel power back in 1917 and has continued the practice ever since. The company owns three 500-b.hp. McIntosh & Seymour engines.



Three solid injection oil engines at Gerlach, Nev. They furnish power for the gypsum-mining operations of the Pacific Portland Cement Co. and have a rating of 800 hp. each

They are four-cylinder, four-cycle machines. Their external appearance is shown in an accompanying photograph (p. 131). California residuum is used as a fuel and costs about $2.10 per barrel. Kerosene is used in starting the engines. The Kennecott company has kept a very careful record over a period of five years that shows average operating costs and economy. From 1918 to 1922 inclusive it cost 0.911c. per kilowatt-hour to generate power at this plant. Details follow:

Average load, per cent	78.1
Fuel used, deg. Bé. at 60 deg. F	18.9
Deg. Bé. at injection temperature (158 deg. F)	24.2
Air injection pressure, lb	936
Lb. of fuel used per net kw.-hr	0.722
Lb. of fuel used per net hp.-hr	0.541
B.t.u. per lb. of fuel oil	18,500
Calculated overall thermal efficiency, per cent	25.7
Gal. of cooling water used per min. per unit	50
Outlet temperature of cooling water, deg. F	137
Cylinders, deg. F	137
Exhaust valves, deg. F	70
Exhaust, deg. F	116
Temperature of exhaust gases, deg. F	733
Total lb. lubricants used per 10,000 net kw.-hr	51.6
Operating Costs	
Cents per kw.-hr., gross *a*	0.866
Cents per kw.-hr., net *b*	0.911
These costs were distributed as follows:	
	Per Cent
Operating labor	18.8
Fuel	51.6
Lubricants	5.6
Sundries	1.8
Maintenance	22.8
	100.0

a By gross kilowatt-hour is meant the actual power output delivered by the generator to the switchboard.

b By net kilowatt-hour is meant the power available for mines and mills after deduction of power used in exciting field.

To operate this plant one engineer and one oiler are required.

Two 600-b.hp. units were installed at Kennecott in the fall of 1922, but on Aug. 2, 1924, they were severely damaged in a fire that destroyed the power plant. However, the engines are again in operation.

The Kennecott installation is not the farthest north of any Diesel oil engine plant in North America. This distinction is held, I believe, by the plant of the Hammon Consolidated Gold Mining Co., a subsidiary of the U. S. Smelting, Refining & Mining Co., which operates two gold dredges near Nome, Alaska. Power is generated by three Werkspoor Diesel engines of 525 b.hp. each, supplied by the Pacific Diesel Engine Co., coupled to a.c. generators of 320 kw. each. Alternating current is generated at 2,300 volts, transformed to 11,000 volts and transmitted four miles to the two electrically operated Yuba gold dredges. The plant was placed in operation in July, 1923. It is planned to double the capacity by installing three more Diesel engines.

The installations so far described have all been of comparatively large size and of the true Diesel type. Hundreds of horsepower are generated in mining districts by oil engines of moderate size, 50 to 200 hp. Generally these engines do not work on the true Diesel cycle and are termed solid-injection Diesels. A lower compression pressure may be used and instead of using high-pressure air for injecting the fuel into the cylinder, the oil itself is injected, thus doing away with the auxiliary air-compressor of the regular Diesel type machine. This significant change in principle of operation and design permits a cheaper engine to be built. Many manufacturers in the United States build these solid-injection engines, and they are extensively used in Canada, Mexico, and the United States. To mention only a few installations: Electric power is generated at the Betty O'Neal mines in Nevada by a 300-b.hp. Fairbanks Morse "Y" type four-cycle Diesel engine direct-connected with a 25-kva. generator. The Ahumada Lead Co. in Mexico uses a similar type of Diesel engine, of 200 hp. capacity. The Premier mine in British Columbia has one of 300 hp. and four of 150 hp.

Metal mining is not the only field laying claim to the wide use of the Diesel engine for generating power. Non-metallic mining also uses the Diesel engine. Cement plants, gypsum, garnet, fuller's earth, and phosphate mines, among others, use Diesel engines. The Pacific Portland Cement Co. has a gypsum mine at Gerlach, Nev., which is located in a desert away from

any hydro-electric or water power. The power problem has been solved by the erection of three 800-hp. eight-cylinder solid-injection Diesel engines made by the Ingersoll-Rand Co. An electric generator is placed in the middle of each engine dividing the cylinders into groups of four, as shown in an accompanying photograph (p. 132). The new gypsum plant of the Standard Gypsum Co. on San Marcos Island, California, will have as its first power plant a 200-hp. Busch Sulzer Diesel engine, while the recently constructed power plant of the Barton garnet mine in the Adirondacks has two De la Vergne engines of 130 hp. each.

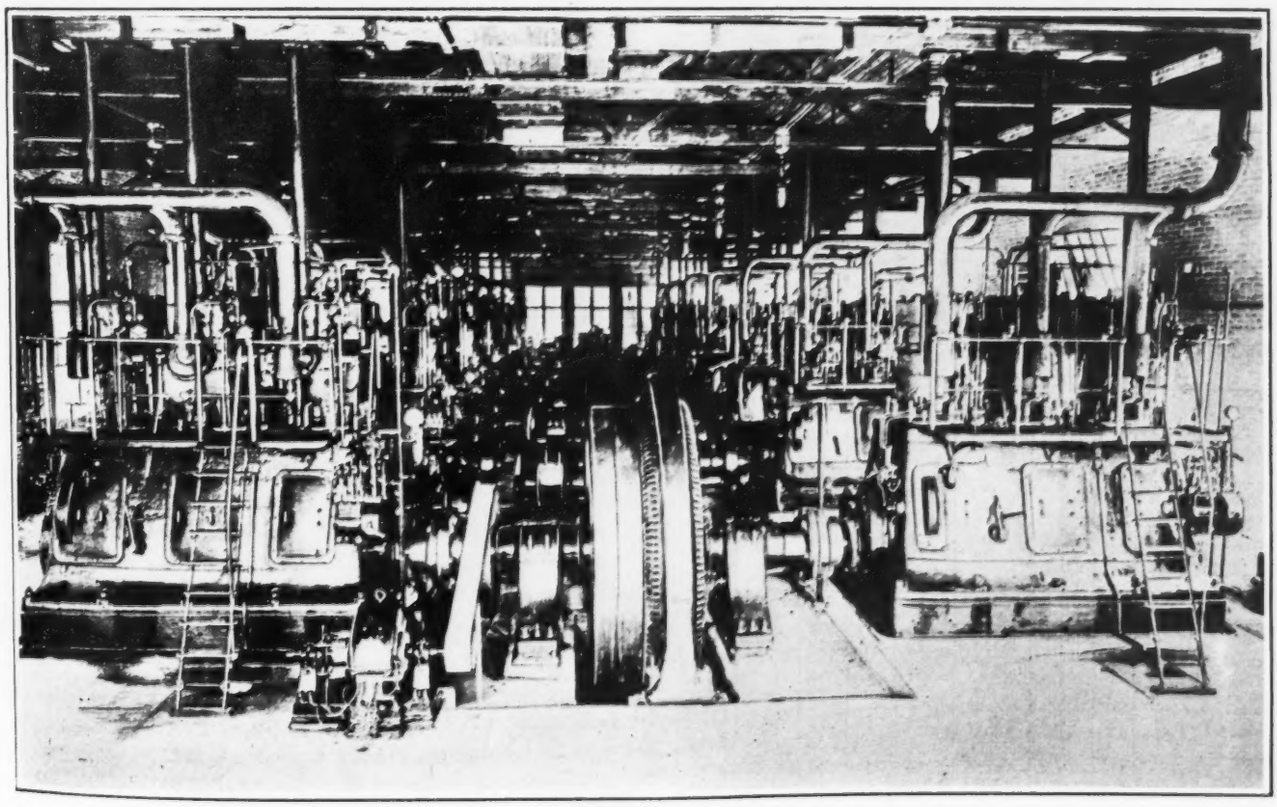
Solid-injection engines, of which the varieties mentioned in the previous paragraph are examples, are a recent development of the Diesel type engine. Fuel consumption is about the same as for the compressed-air injection Diesel, but they will not burn so wide a range of fuels handled. In some types, particularly the De la Vergne and the Ingersoll-Rand solid-injection engines, two fuel sprays are used, set at an angle in the combustion chamber. Sprays from the nozzles impinge upon each other, greatly facilitating atomization of the fuel and proper combustion. (See the diagram of the Ingersoll-Rand engine, p. 127.) The solid-injection type of engine can be generally started from a cold condition, owing to the good vaporization at compression pressures of about 350 lb. per square inch. Governing of the solid-injection engine is accomplished by shortening the period of fuel injection, or bypassing some of the fuel in the feed.

Cost of the Diesel

What does a Diesel engine cost? To answer this question I have prepared a table showing the range of costs of Diesel engines as supplied by various manufacturers. The costs of the manufacturers reporting range between $65 and $90 per b.hp., f.o.b. plant, and are lowest naturally for the larger engines. On p. 126, a curve is presented that has been worked out by L. H. Morrison of *Power* showing the installation cost of Diesel plants of varying capacity. The points on this curve include all investment costs other than ground space. Naturally the smaller the unit the greater the cost of the machine.

One of the main reasons why the Diesel engine is not used as widely as it should be is the reluctance of engineers to concede a long life to the Diesel, although they are perfectly willing to admit superior thermal efficiency. Being a comparatively young prime mover, the Diesel engine, unlike the steam engine, has not had ample opportunity to demonstrate its long life. Probably the greater number of moving parts in a Diesel engine has led to the belief that the Diesel is not a long-lived prime mover. As actual operating records are gradually becoming recorded and accumulated, operators are discovering that the Diesel engine has a life that can conservatively be estimated at twenty-five years. Yet it is common to find briefer periods used in cost of power estimates. If twenty-five years is assumed as the reasonable life expected, the depreciation to be charged off each year is roughly 4 per cent of the initial cost; if the period is taken as 16⅔ years the depreciation amounts to 6 per cent per annum, a common charge. For a 1,000-kw. plant costing, say, $100,000 installed, this difference would amount to $6,000 minus $4,000, or $2,000 per year, or about $32,000 in sixteen years.

There is one charge to which the Diesel engine should not be subjected, and that is the item of obsolescence. The Diesel engine manufactured today is only slightly,



One of earliest Diesel engine power plants in the United States

The first unit was installed in 1906 at the Mulberry, Fla., phosphate operations of the International Agricultural Corporation; six more were added in 1907 and an eighth in 1910. Each develops 450 hp. and is in regular service today

Details of Various Diesel and Solid-Injection Oil Engines

Manufacturer	Number of Cylinders	Cylinder Arrangement	Cycle Used	Brake Hp.	R.P.M.	Cylinder Bore, Inches	Cylinder Stroke, Inches	M.E.P. (brake)	Weight in lb. per b.hp.	Thermal Efficiency per b.hp.
Busch-Sulzer	3 to 6	V (a)	4	300 to 600	225	16¼	23	73.8	....	33
Busch-Sulzer	4 to 8	V	2	750 to 1,500	180	17	27	67.2	....	33
Busch-Sulzer	4 to 6	V	2	2,500 to 3,750	124	30	42	67.2	....	33
Fulton	3 to 8	V	4	100 (b)	200	17	24½	71.2	....	..
Fulton	3 to 8	V	4	187.5 (b)	164	23	29½	73.8	....	..
Bessemer	3 to 4	V	4	50 & 70	400	7½	10½	90	90 & 102	..
Bessemer	3 to 6	V	4	85, 110 170	350	8½	12	90	100 to 117	..
Bessemer	3 to 6	V	4	110, 150 230	300	9¼	14	100	114 & 118	..
Bessemer	3, 4, 6	V	4	175, 235 350	277	11½	16	100	125 & 133	..
Bessemer	3, 4, 6	V	4	210, 280 420	257	12½	18	100	137 & 147	..
Bessemer	3, 4, 6	V	4	335, 450 670	225	15	22	100	146 & 155	..
New London Ship & Engine	..	V	4	120	350	9	12	85.4	151	30
New London Ship & Engine	..	V	4	300	260	12	18	74.8	150	31.6
New London Ship & Engine	..	V	4	600	205	16	24	75.4	200	32
New London (c) Ship & Engine	..	V	2	3,300	95	27.55	47.25	64.7	215	32.8
Worthington	..	V	2	30 to 120	375	10¼	10	37	150 to 200	..
Worthington	..	V	2	50 to 200	325	12	13¼	37	150 to 200	..
Worthington	..	V	2	75 to 450	275	15¼	16	37	150 to 200	..
Worthington	..	V	4	200 to 1,000	200	17	25	70	250 to 300	..
Worthington (c)	(d)	V	2	200 to 250 (b)	135 to 180	16	24	60	140 to 180	..
Worthington (c)	(d)	V	2	400 to 550 (b)	100 to 140	22	34	60	140 to 180	..
Worthington (c)	(d)	V	2	700 to 950 (b)	90 to 125	28	40	60	140 to 180	..
Worthington (c)	(e)	V	2	1,000 to 1,500 (b)	80 to 110	34	48	60	140 to 180	..
Nordberg	3 to 6	V	2	330 to 660	225	15	20	55	....	30
Nordberg	3 to 6	V	2	450 to 900	225	16¾	22	56	....	30
Nordberg	3 to 6	V	2	750 to 1,500	180	20¾	26	61¼	....	32
Nordberg	3 to 6	V	2	1,650 to 3,300	120	28	44	67½	....	33
Nordberg	3 to 6	V	2	2,000 to 4,000	120	29	48	68	....	33
Foos	1 to 8	V	4	50 to 400	275	12	18	70.2	275	..
Krupp (h)	2 to 6	V	4	45 to 100	320 to 400	22 (f)	35 (f)	...	....	34.5
De la Vergne	2 to 6	V	4	130 to 400	277	14½	18	62½ to 64.1	372 to 256	34
De la Vergne	3 to 6	V	4	300 to 600	225	17	24	64.7	367 to 268	34
De la Vergne	3 to 6	V	4	500 to 1,000	180	21	30	70.2 to 70.6	351 to 291	34

(a) V=vertical.
(b) Per cylinder.
(c) Double-acting engine.
(d) 2, 3, 4, 5 or 6 cylinders.
(e) 3, 4, 5, 6 or 8 cylinders.
(f) In centimeters.
(h) Smallest and largest type only listed.

if any, more efficient than the engine that was first commercially developed, and there is small hope that a prime mover will be devised to improve upon the quality and work of the Diesel.

Enough plants have been described to show that the Diesel engine is very popular among mining companies and that it is being used to supply power in both small and large amounts. Unfortunately, the merits of the Diesel engine and its advantageous properties and peculiar adaptability to mining purposes are not so well known as they should be. The power problem at a mine frequently resolves itself into generating power at an isolated region where fuel is difficult to obtain and water sometimes scarce, even for cooling purposes, and where purchased power is out of the question. It is in just such circumstances that the Diesel engine shows to advantage. If this brief paper has done nothing more than indicate the growing and widespread use of the Diesel engine and the need of an appreciation of its economic status and work, the effort of its preparation will have been repaid handsomely. The Diesel should have full and careful consideration in any projected power installation or power purchase.

An Extinct Volcano on Alaska Peninsula

Aniakchak crater, on Alaska Peninsula, is one of the most remarkable natural objects on this continent, says a bulletin of the U. S. Geological Survey. It is an enormous basin, the floor of which measures 6¾ by 5¾ miles, an area more than half as large as the District of Columbia. The rock walls that form the rim of the crater rise in places 3,000 ft. above its floor, and a cinder cone in the crater rises to a height of 2,200 ft., four times that of the Washington Monument. In a hollow in the crater's floor lies a lake that is two and one-half miles long and of two square miles area.

A further measure of the magnitude of the crater may be had by comparing it with better-known volcanic craters, such as Kilauea, in the Hawaiian Islands, which has a diameter slightly less than three miles, or the pit occupied by Crater Lake, in Oregon, which has a diameter of about five and one-half miles, both being smaller than Aniakchak. Estimates of the amount of material that has been ejected from the present crater vary greatly, but the smallest quantity indicated by the available facts is about eight cubic miles, and the actual quantity may have been more than sixteen cubic miles.

There is no record that this volcano has been in eruption within historic time; in fact, the channels cut by the streams that flow down its slopes and the growth of vegetation on the ash from the crater indicate that Aniakchak crater is one of the oldest in the whole series of volcanoes along the Aleutian range.

The Aniakchak district, the broad prairie-like valleys of which are rimmed by majestic sharp-peaked mountains, is impressive and in many respects unique. The former scene of terrific earth convulsions is now almost oppressively quiet, and the somber landscape, overswept by fitfully driven clouds, presents an aspect that is most weird.

Aniakchak crater was discovered in August, 1922, by a party in charge of R. H. Sargent, of the Geological Survey, while they were searching for possible petroleum-bearing areas in the Alaska Peninsula. A report by W. R. Smith, the geologist of this party, has recently been issued as Professional Paper 132-J of the Geological Survey.

Differential Flotation of Copper and Iron Sulphides*

Microscopic Examination to Determine Degree of Association Necessary First — Tests Show Importance of Cyanide as a Reagent for Dropping Pyrite

By Harmon E. Keyes

Associate Metallurgist, Southwest Experiment Station (Tucson, Ariz.), U. S. Bureau of Mines

Harmon E. Keyes

A PROBLEM of increasing importance to the copper-smelting industry of the Southwest is that of excess iron in the furnace charges. However, the elimination of this trouble lies not within the domain of the smelters themselves, but in the concentration of the ore. Improved methods of concentration, in raising the grade of copper in the concentrate, are tending to drop out more and more silica, but much of the undesirable pyrite, instead of going into the tailing, is found in the product delivered to the smelter.

The possibility of separating the copper sulphide from the iron sulphide minerals by flotation depends, first, upon the degree of association of the minerals in question, and second, upon the relative flotability. An investigation is in progress at the Intermountain Experiment Station of the U. S. Bureau of Mines at Salt Lake City in which the mineralogical characteristics of typical copper ores of the Southwest are being studied microscopically. A continued study is being made there simultaneously on reagents and methods for dropping pyrite. The results of this work should help to determine the fineness of grinding necessary to free the copper and iron sulphides mechanically and to give additional information as to the feasibility of dropping pyrite.

When the degree of association permits of mechanical separation without excessively fine grinding, the differential separation of copper and iron sulphides has been found possible on certain ores by modern flotation methods. A typical example of excellent current practice is that of the Moctezuma Copper Co.,[1] Sonora, Mexico, where selective action in flotation is obtained and most of the pyrite eliminated by an alkaline circuit using lime, together with some of the more recently developed frothing agents.

Experiments on some of the more refractory copper sulphide ores have disclosed the advantages of sodium cyanide in the differential flotation of copper sulphides in the presence of pyrite. Noteworthy in this line of research is the work of Sheridan and Griswold,[2] who demonstrated the inhibitory action of cyanides on the flotability of pyrite. This discovery has application in the concentration of ores containing pyrite together with lead, zinc, silver, and copper sulphides, whereby the pyrite sinks with the gangue and the other sulphides are floated either collectively or selectively. This article being limited to copper ores, the treatment of zinc-bearing material will not be considered here. In carrying out the invention the ore is ground to a pulp containing 30 to 80 per cent water and is treated with a cyanide and an alkaline salt such as sodium carbonate, bicarbonate, or even caustic. Satisfactory results are claimed by using from a fraction of a pound to 4 lb. of an appropriate cyanide per ton of ore, and from 1 to 10 lb. of alkaline salt. The cyanide and alkali are mixed with the ore pulp previous to flotation, and it is claimed the effectiveness of treatment is enhanced by heating the ore pulp before floating.

When lead and zinc occur, the copper may follow either the lead or the zinc, depending on the form in which the copper is present in the ore, according to the inventors. Thus, when copper is present as chalcopyrite, it is removed with lead sulphide, but when present as chalcocite or covellite, it is largely removed with zinc sulphide. Chalcopyrite is more readily amenable to the ordinary flotation procedure than the other sulphides of copper, and although there is a marked difference in the amenability of the various copper sulphides to flotation, the process of the invention makes it possible to separate the copper and iron sulphides by differential flotation irrespective of the presence of lead and zinc. Likewise, the pyrite may be largely eliminated from an ore containing copper in the form of chalcocite, covellite, or bornite.

Cyanide Forms Complex Salts

The inventors are of the opinion that the action of the cyanide on the iron sulphide is to form a coating of complex ferrocyanides and ferricyanides, which are, in turn, converted to the hydrated oxide of iron by the action of the base present. It is claimed that at no stage of the process is the iron sulphide easily floated.

The results of some tests by Sheridan on an ore typical of a large tonnage in the Southwest may well be given here. It has later been found that the sodium cyanide added may be cut to fractions of a pound per ton and that this materially improves the silver recovery.[3] More than 80 per cent of the ore tested was pyrite, the copper being present as chalcopyrite. The constituent minerals were substantially freed by grinding to 150 mesh. The pulp was conditioned by grinding with 2 lb. of caustic soda and 1 lb. of sodium cyanide per ton of ore in jar mills. The test was conducted with an M.S. standard flotation machine at 60 deg. F.,

*Published by permission of the Director, U. S. Bureau of Mines, Department of the Interior.

[1] *E. & M. J.-P.*, Vol. 118, No. 12, pp. 452-3.

[2] U. S. Patents 1,421,585; 1,427,235. 1922.

[3] G. E. Sheridan, private communications.

using about 1 lb. Barrett No. 4 flotation oil per ton of ore. During flotation the pulp density was 4.2 : 1. The following results were obtained:

	Assay Percentage		Recovery Percentage	
	Cu	Fe	Cu	Fe
Feed	3.00	38.8	....	....
Concentrate	17.00	38.3	80.5	14.0
Middling	3.10	34.5	10.3	8.9
Tailing	0.40	39.8	10.1	77.7

It is seen that the composition of the middling closely approximates that of the feed, and if the middling be carried as a circulating load with possible regrinding, the net extraction of copper in the concentrate should approximate 90 per cent.

Subsequent to, but independent of, the work of Sheridan and Griswold, Henry Eyring,[1] research fellow of the Southwest Experiment Station of the U. S. Bureau of Mines, conducted an investigation on the differential flotation of a heavy sulphide ore from the Gleason mine having a somewhat similar composition to the ore above mentioned. Likewise, this material appeared to be typical of a large available tonnage. A partial analysis showed the following percentage composition: Cu, 3.85; Fe, 39.5; CaO, 0.1; "insoluble," 4.57; S, 42.7. The copper proved to be distributed as follows: Oxides, 32.0 per cent; chalcocite, 42.2 per cent; chalcopyrite, 25.8 per cent. Standard methods of analysis were used in determining the different forms of copper.

A microscopic examination of a great number of grains showed that about one-half the copper occurred in particles between 0.4 and 0.07 mm., about one-third in veinlets between 0.07 and 0.02 mm., and the remaining one-sixth in films between 0.02 and 0.01 mm. thick. Most of the ground mass being pyrite, grinding to nearly 200 mesh was necessary to free the copper minerals. A comparison of this ore with a sample from the Jerome district showed marked similarity of mineralogical composition.

In preparing the ore for testing, 500 grams was mixed with water and ground with steel balls in an Abbe mill for a definite time. The pulp was then further diluted and agitated in a Janney flotation machine. The reagents were added after the grinding period. The frothing agents used were 0.3 to 1.0 lb. per ton of "TT" mixture (thiocarbanalide and orthotoluidine) and from 0.1 to 0.3 lb. per ton of pine oil. Under these conditions a number of alkaline addition agents were tried, including sodium carbonate, hydrate, cyanide, and quicklime. The tests showed successful results when sodium cyanide was employed in amounts of 2 to 8 lb. per ton of ore, but the other alkaline reagents produced a low-grade concentrate as well as a high copper tailing. Below are given some of the typical data in abridged form:

	Tailing		Concentrate			Reagent			
Test No.	Assay, Cu, Per Cent	Wgt., Gm.	Per Cent Cu	Wgt., Gm.	Hours Grind	Liquid	Lb. Per Ton	Solid	Lb. Per Ton
3	2.35	195	6.44	115	1	TT pine oil	0.3 0.33	Quicklime	2
4	2.71	440	12.99	38	1	TT pine oil	0.3 0.22	.....	.
12	1.09	359	23.60	49	3	TT pine oil	1.05 0.11	Sodium cyanide	2

In addition to the above products, several middlings were produced, the composition of most of which approximated that of the feed. This material would normally be returned by adding to the feed. Although the conditions, aside from the alkaline reagent, were not maintained entirely constant in the different experiments, yet consistently better results were obtained over a considerable number of tests using cyanide than with any of the other alkaline reagents tried.

The close agreement of the results of Sheridan and Eyring is worthy of attention. The work of the two was independent of each other, yet the ores tested were somewhat similar in composition. Each was of a refractory character and represented large tonnages.

When the possibilities of freeing the copper minerals from associated pyrite have been investigated microscopically the question of differential flotation will logically receive consideration. It is not unlikely that cyanides may play an important rôle in solving the metallurgical problems of the Southwest.

[1]Eyring, Henry, "The Differential Flotation of the Copper Minerals in a Heavy Sulphide Ore," Thesis, University of Arizona, 1924.

Mexican Monetary System Unified

Under a presidential decree of April 29, 1925, the monetary system of Mexico has been unified, according to *Commerce Reports*. A description of the coins to be used in accordance with the law follows:

Peso. At present there are four distinct peso pieces in circulation. The decree provides that after Dec. 31. 1925, only the peso created by the law of 1919, with a fineness of 0.720 (marked on the obverse side), will be legal.

50 centavos. Four distinct 50-centavo pieces are in current circulation. The decree provides that after Dec. 31, 1925, only the piece created by the law of 1919, with a fineness of 0.720, will continue in circulation.

20 centavos. There are now in circulation four distinct silver pieces and one bronze coin. The decree retires three of the silver ones and the bronze one, leaving only the silver piece of 0.720 fineness.

10 centavos. The principal change is in the 10-centavo denomination. The decree retires the three silver pieces and one bronze piece now in circulation and creates a new "decimo" which is to have the same size as the piece coined in 1918 but which will have the mark 0.720 on the obverse side to show its fineness. The weight of ten of these "decimos" will be exactly that of the silver peso piece.

All the suppressed coins will cease to circulate after Dec. 31, 1925. The demonetized silver pieces will be exchanged for silver pesos 0.720 fine, but not for gold.

Bronze coins of 1, 2, and 5 centavos will continue in circulation. The present nickel 5-centavo pieces will circulate until the present supply is exhausted, but no new pieces of this material will be coined.

Phosphate Rock Shipped in 1924

The phosphate rock shipped from mines in the United States in 1924 amounted to 2,771,000 long tons, valued at $9,740,000, according to preliminary figures compiled by the U. S. Geological Survey. Florida, the leading producing state, shipped 2,336,000 long tons, worth $7,507,000, more than nine-tenths of which was land-pebble phosphate. Shipments from Tennessee and small quantities from Kentucky amounted to 396,000 tons. Idaho, Montana, and Wyoming made small shipments.

The posphate rock mined in the United States in 1924 amounted to 2,756,000 long tons, which is 6 per cent less than that mined in 1923. More than four-fifths of it was mined in Florida. Most of the remainder was mined in Tennessee and Kentucky.

Possible Inorganic Petroleum

An Inquiry as to Quantitative Adequacy

By J. Volney Lewis

Professor of Geology, Rutgers College, New Brunswick, N. J.

HYDROCARBONS occur somewhat widely among volcanic emanations, ranging from a mere trace to nearly 100 per cent of the "dry" gases. Nevertheless, the evidence now available points clearly to the origin of great accumulations in some manner from some kind or kinds of organic matter, and it has been thought that even the hydrocarbons associated with igneous phenomena may have a similar source. The prevailing opinion is well expressed by Clarke (Data of Geochemistry; Bull. U. S. G. S. 770, 1924, p. 747), who says:

> We may admit that hydrocarbons are formed within volcanoes, but the quantities definitely traceable to such a source are altogether insignificant. Bitumens occur in small amounts in many igneous rocks, but never in large volume. They are, moreover, absent, at least in significant proportions, from the Archean, and first appear abundantly in Paleozoic time. From the Silurian upward they are plentiful, and commonly remote from great indications of volcanic activity.

Several points in this statement call for brief comment, and it may be found that the force and significance of some of them will bear modification.

Difficult to Assign Specific Source

Presumably few advocates of inorganic origin will question the accuracy of Clarke's statement, "The quantities definitely traceable to such a source are altogether insignificant." The fact that some great stores of hydrocarbons cannot now be traced definitely, or even satisfactorily, to a particular source in the field does not modify in any material way the force of this statement. It does serve, however, to emphasize the immense difficulty of assigning the hydrocarbons in many regions to any specific source. In some fields the difficulty consists rather in the embarrassment of riches, where any one or more of several carbonaceous strata may be regarded as possible sources. In other districts, on the other hand, where petroleum is equally abundant and widespread, the effort to identify any adequate source whatever makes great demands upon the imagination.

Absence From Igneous and Metamorphic Rocks

The general absence of bitumens in large amounts from igneous and metamorphic rocks has little or no significance as to possible inorganic origin. With equal force the same argument might be applied to water, which is certainly produced from magmatic sources in vast quantities; yet it finds storage in the crystalline rocks in very small amounts. The reason is simply that these formations generally lack the essential traps and reservoirs. Under exceptional conditions, it is true, porous igneous rocks have been found to contain petroleum in considerable quantity, but the association seems to have no bearing upon the problem of origin.

Graphitic schists and many other metamorphic rocks, even of Archean and Algonkian age, contain great stores of residual carbon. Much of this material doubtless represents original organic matter, and, moreover, some of it has probably passed through successive stages as hydrocarbons. Metamorphism has dissipated most of the materials and destroyed the reservoirs that contained them, so that little capacity remains for the storage of bitumens that might afterward have found their way into such rocks.

Storage Remote From Volcanic Activity

Important stores of hydrocarbons, even if inorganic in origin, must necessarily accumulate in regions more or less "remote from great indications of volcanic activity," for these districts are so abundantly fissured and perforated with vents that volatile materials find ready escape to the surface. Moreover, the open structures permit easy access of air and surface waters, so that hydrocarbons rising through them, from any source, would be largely destroyed by oxidation.

Reservoirs, and Mingling From Various Sources

Petroleum and natural gas can generally be concentrated in quantity only in those little altered strata that are capable of furnishing the necessary structures and textures. Hence the mere fact of the preponderant occurrence of these materials in the sedimentary rocks has little or no direct bearing on the problem of origin. Its significance lies in the fact that these are the only reservoir-rocks of great capacity. It is obviously necessary, therefore, to amend Clarke's statement, that hydrocarbons "first appear abundantly in Paleozoic time," so as to read "appear abundantly only in unaltered or little altered strata."

In many of these structural traps hydrocarbons from two or more organic sources may be mixed in all proportions; and where similar materials of inorganic origin arise, they must also commonly become mingled in some degree with the organic derivatives. The problem of identification, therefore, may be likened to that of distinguishing the several plagioclase feldspars. When we recall the various kinds of organic matter, plant and animal, and the numerous hypotheses concerning the derivation of bitumens from them, the complication of the problem is greatly increased. I do not, of course, overlook the multiplicity of inorganic hypotheses also. It does not seem unreasonable, however, to hope for the detection of vestiges that will serve at least to distinguish between the great organic and inorganic classes. A beginning can then be made on the accumulation of data from which the relative importance of the two classes may be estimated.

Igneous Magmas Unsaturated With Oxygen

Most igneous magmas must be assumed to have originated, or at least to have acquired their dominant characters, high within the outer silicate shell of the earth. Nevertheless, they doubtless continue to accumulate additional stores of oxygen for long distances and long periods of time on their upward journey. They never become saturated with it, however, and 57.9 per cent of the total iron in the average igneous rock is still in the ferrous state. Volcanic gases also often arrive at

the surface with some of their constituents unoxidized or only partly oxidized, particularly hydrogen, carbon monoxide, and methane. The same substances are universally present among the "occluded" gases of the igneous rocks, and are more abundant in those of deep-seated origin than in surface lavas. In all cases hydrogen, after water, exceeds all the rest; next in abundance is carbon dioxide; and this is followed in order by carbon monoxide, methane, and nitrogen. At depths below the zone of freezing magmas it may be supposed that unoxidized materials exist in larger proportions. Indeed, there is much support for the hypothesis that the earth has a great metallic core, free from oxygen, perhaps consisting essentially of nickel-iron; and that surrounding this is a thick stony shell, in which the proportion of oxygen increases progressively to the surface. (H. S. Washington, *Jour. Wash. Acad. Sci.*, Vol. 19, 1924, pp. 435-442.)

The Original Magmatic Gases

The nature of the occluded gases led Chamberlin and Salisbury ("Geology," Vol. I, p. 620) to the conclusion that "the standard original gases of the lavas are the elements or compounds of hydrogen, carbon, and nitrogen, in the order named, while chlorine and sulphur gases are to be regarded as accessory."

Methane, which is universally present, is the logical source of the hydrogen and carbon. Hence both the free hydrogen and carbon monoxide, on the one hand, and portions of the magmatic water and carbon dioxide, on the other, may reasonably be attributed to the reaction of this hydrocarbon and its derivatives with oxidized materials encountered on the upward journey of the magma. Such reactions may be suggested empirically by the following equations, in which hypothetical FeO represents various ferrous minerals:

$$CH_4+2Fe_2O_3=CO+H_2O+4FeO+H_2$$
$$CO+Fe_2O_3=CO_2+2FeO$$
$$CO+3Fe_2O_3=CO_2+2Fe_2O_4$$

The available oxygen at any particular stage of the magma will be apportioned among the iron, hydrogen, carbon, and other constituents according to conditions of chemical equilibrium, which are largely determined by pressure and temperature. The fact remains, however, that regardless of its distribution, there is a persistent deficiency of oxygen under the conditions of igneous intrusion, as shown by the generally observed fact that magmas and their emanations are themselves reducing in character. Thus ferric oxide and hydroxide in iron-stained sediments and ash beds are found reduced, in zones of contact metamorphism, to magnetite and various ferrous minerals.

Heat of Combustion

The temperature and liquidity of rising magmas are maintained, and even augmented, in important degree by the combustion of oxidizable materials. At Kilauea, for example, it has been observed that the temperature of the lava rises when escaping gases are plentiful and drops again when less gas is discharged, the fluctuations covering a range of 500 to 600 deg. C. (Day and Shepherd, Bull. G. S. A., Vol. 24, 1913, p. 601; Jaggar, *Am. Jour. Sci.*, Vol. 44, 1917, p. 161.) The flames of this combustion are visible under favorable conditions, and similar flames have been observed repeatedly at the crater of Santorin. (Fouqué, Santorin, Paris, 1867; Schmidt, Vulkanstudien, Leipzig, 1874.) Here is direct evidence that portions of the magmatic water and carbon dioxide are produced by the oxidation of hydrogen and carbon at and near the surface.

The frequent presence of methane among the surface emanations, even in the shattered and deeply oxidized volcanic belts, and its universal occurrence among the gases imprisoned in the deep-seated igneous rocks point clearly to the hydrocarbons as the source of much of the magmatic hydrogen and carbon that appear at the surface as water and carbon dioxide. That similar materials, rising in unbroken and little oxidized regions, would approach the surface with far greater proportions of hydrocarbons is a conclusion that cannot readily be avoided. Moreover, the quantities involved can scarcely be considered "altogether insignificant."

Where surface leakage has not been established, these hydrocarbons may be sealed in with the deep intrusive magmas, only to find their way upward slowly in succeeding ages. As they rise they will naturally be caught, in part, like those of organic origin, by such structural traps as may exist in the overlying strata.

Quantitative Data Lacking

Quantitative data are very meager concerning the vast amounts of water and carbon dioxide emitted by volcanoes, and are wholly lacking as to the proportions of these gases that have been produced by direct combustion of magmatic hydrocarbons.

Fouqué estimated that a single parasitic cone of Etna gave off steam equivalent to 2,100,000 cu.m. of water in one hundred days. No attempt was made to estimate the carbon dioxide. When we consider, not a mere parasitic cone and a brief one hundred days, but the main crater of Etna, together with the hundreds of parasitic cones and the fumaroles innumerable, throughout the whole life history of the volcano—back through the unreckoned centuries and forward to its extinction in the dim future—the estimates of these gases mount up to totals that are inconceivably vast. A minute fraction of such emanations, escaping oxidation, in a region where surface vents have not been established, might well yield a volume of hydrocarbons in excess of the contents of any producing field. As portions of these gases fall into structural traps, the oxidation products would naturally be dispersed in the ground waters.

Probably such volatile substances are slowly diffusing surfaceward in all parts of the earth, since rocks and minerals everywhere seem to have become charged with them, or with selectively adsorbed and dissolved portions of them. Under such conditions, any rise in temperature or drop in pressure anywhere releases these gases, or distills them off in part, and sends them on again toward the surface.

The lighter gaseous hydrocarbons, whatever their origin, may be stepped up to petroleum and the heavier bitumens through the action of catalysts and radioactivity. DeGolyer has called attention to the occurrence of nickel and vanadium in petroleum (*Ec. Geol.*, Vol. 19, 1924, p. 550); and Ramsay, who finds nickel in every oil examined, has emphasized its action as a powerful catalyst. (*Jour. Inst. Petroleum Technologists*, Vol. 10, 1924, pp. 87-91; reviewed by Hess, *Bull. Am. Asso. Petr. Geologists*, Vol. 8, 1924, pp. 832-4.) Moreover, Lind and Bardwell (*Sci.*, Oct. 17, 1924, pp. 364, 365) report the direct synthesis of liquid hydrocarbons from ethane gas by the action of radon (radium emanation), with the separation of free hydrogen, and also the similar action of radon on paraffin, which was observed by Rutherford and Boltwood. In

the case of ethane the apparent reaction is as follows, although probably there are intermediate stages:

$$4C_2H_6=C_8H_{18}+3H_2$$

In view of these results and the universal presence of radium emanations in the earth's crust, Thom (*Bull. Am. Asso. Petr. Geologists*, Vol. 8, 1924, pp. 830, 831) suggests that there may be more than a mere fortuitous association between helium, which is present in many oil-field gases, and the character of the associated oils.

Status of the Magmatic Hypothesis

The organic origin of vast stores of petroleum may be regarded as firmly established, and at present the presumption is in favor of such origin, even in regions where the specific source cannot be found. It does not follow, however, that the organic theory is exclusive. I would emphasize the potentialities of the magmatic source and suggest the possibility, even the probability, that some of the larger accumulations, and portions of many others, will eventually be identified with deep-seated igneous origin.

Many elements, formerly unsuspected, have been discovered among the minor constituents of petroleum, natural gas, and oil-field waters. The presence of nickel, manganese, vanadium, uranium, lead, phosphorus, boron, helium, and rarer gases, and also the great variations in nitrogen and sulphur and their compounds, suggest puzzling questions. At present the significance of many of these constituents is by no means clear. The same uncertainty also applies to the excessive temperatures found in many oil regions and to the pronounced magnetic irregularities in some.

The student of these phenomena will realize, therefore, that in the present state of knowledge the igneous magma must be regarded as a potential source of petroleum, and hence he will retain it in his varied assortment of working hypotheses.[1]

Gold Prospecting in Lapland

A joint-stock company, known as O/Y Ivalojoki A/B., has recently been formed in Helsingfors, Finland, for the purpose of exploiting gold in the river beds of Ivalojoki and tributaries in Lapland, according to the assistant trade commissioner at Helsingfors. The capital, amounting to 6,000,000 Finnish marks (the Finnish mark exchanges at present at approximately $0.0252), is divided into 6,000 shares in denominations of 1,000 marks each, 3,000 of which have been subscribed by the founders of the concern, the remainder being offered to the public. Gold has been panned along the Ivalojoki for the past fifty years, and it is estimated that along this river and its southern tributaries about 500 kilos has been produced. According to a survey made last summer and during the winter of 1924-25 an appreciable quantity may be found in Ivalojoki and Sotajoki over a length of 4.5 kilometers, which admits of dredging by machinery on a comparatively important scale, and, in addition, 30 or 40 kilometers of gold-bearing strata are thought to be located in the beds of Ivalojoki and tributaries. In this survey the amount of gold per cubic meter of earth proved to be from 1 to 5 grams. This company expects to operate with machinery instead of the primitive means formerly employed, commencing some time during this summer.

[1] I am under obligations to J. E. Spurr and Dr. A. C. Spencer for kindly criticism of the preliminary drafts of this paper.

Natural Paint Pigments—Ochers and Oxides

In a recent bulletin of the New South Wales Geological Survey, H. G. Raggatt has a brief chapter on natural paint pigments. An ocher, he says, may be considered as a clay that contains sufficient oxide of iron to enable it to be used as a pigment. When the percentage of ferric oxide is high (exceeding, say, 40 per cent) the term "oxide" is used in preference to "ocher." Ochers are, as a rule, easily pulverized. In yellow and brown ochers the iron is contained in the form of hydrated oxide, limonite, or goethite; in red ocher it is contained in hematite.

Bole is a red, friable, earthy clay.

Umber is essentially hydrated ferric oxide, containing a noteworthy percentage of manganese.

Laterite consists of clay and the hydroxides of iron and aluminum. In many places laterite includes a considerable amount of sand.

In this bulletin all these substances are included under the general heading of ochers and oxides.

Most iron oxides suitable for use as pigment are of secondary origin. Their occurrence is widespread, and they are found associated with a great many different kinds of rocks. The hydroxides of iron are derived from the alteration of other iron-bearing minerals by the normal processes of weathering. They may be formed, mixed with clay and other impurities, by the decomposition of both igneous and sedimentary rocks, and by the alteration of metallic lodes. Iron-bearing waters issuing from springs may yield ocherous deposits, in many places associated with silica and the carbonates of calcium and magnesium.

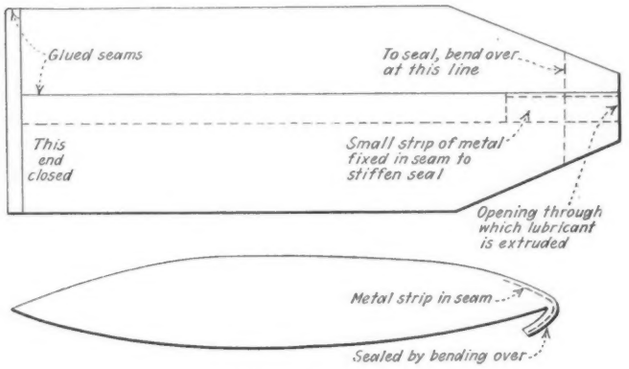
Trade Requirements

The principal properties considered by paint makers in selecting their raw materials are the depth, richness, and shade of color of the ground product in oil, the staining power, and the fineness of the material, or the ease with which it may be ground and refined. These properties can be determined only by one who has had considerable experience in the grinding and selecting of pigments. Without practical tests it is almost impossible to say whether a given ocher or oxide will be salable or not. The chemical composition is of little value, except to separate those substances that may be of some use from those that certainly will be useless. A high percentage of ferric oxide is not necessarily conducive to the production of a good color. A yellow ocher or oxide is more likely to command a market than a red, because the former may be more easily modified in color, either by calcining or the addition of other colors, than the latter. The individual prejudices of the millers and paint makers must also be considered as a very important factor in determining the type of pigment for which a market may be found. In preparing ochers and oxides for use in paint, the crude pigment is first subjected to dry grinding, followed by sifting through screens of wire gauze or silk. A finer and more uniform product is procured by wet grinding and levigation. By this means, also, the removal of the more objectionable impurities, of which free silica is the chief, is assured. When wet methods have been employed it is essential to insure uniform drying conditions prior to grinding the prepared pigment in oil. For most pigments raw linseed oil is the chief, or sole, grinding medium used.

Useful Operating Ideas

Container for Distributing Rock Drill Lubricants

A new plan for distributing lubricants to drill operators in the mine has been developed at the Miami Copper Co., Miami, Ariz., and consists of supplying liquid grease in small paper tubes containing sufficient lubricant for one drilling shift. The paper container, which is formed of a single blank of tough paper impervious to oil and for which a patent has been applied by Louis Ware, assistant mine superintendent,


Glued seams
To seal, bend over at this line
This end closed
Small strip of metal fixed in seam to stiffen seal
Opening through which lubricant is extruded
Metal strip in seam
Sealed by bending over

Stiff paper container for rock drill lubricants

can be manufactured cheaply. The construction of the container is shown in the accompanying illustration. The package tapers toward the open end, from which the grease is extruded by pressure on the sides of the container. Inserted in the seam near the opening is a small piece of metal about ¼ in. wide and 1 in. long, which serves to stiffen the seal, formed by bending the spout over about ½ in. from the end. Since the lubricant is used several times during the shift, the tight seal that is effected by bending is important. The miner forces the lubricant into the machine as needed, and when the container is emptied, it is thrown away. Its cheapness is of especial advantage. The most practical size used is that which contains about 4 oz. of grease.

The containers are filled at the surface supply base by a machine consisting of a cylinder from which the lubricant is extruded through a small spout by means of compressed air. Large numbers of these packages are prepared and sent into the mine for subsequent distribution from the underground supply base. As the miners come on shift, each takes a package of grease to meet the day's requirements. After the container is empty, it is thrown into the chute or otherwise destroyed.

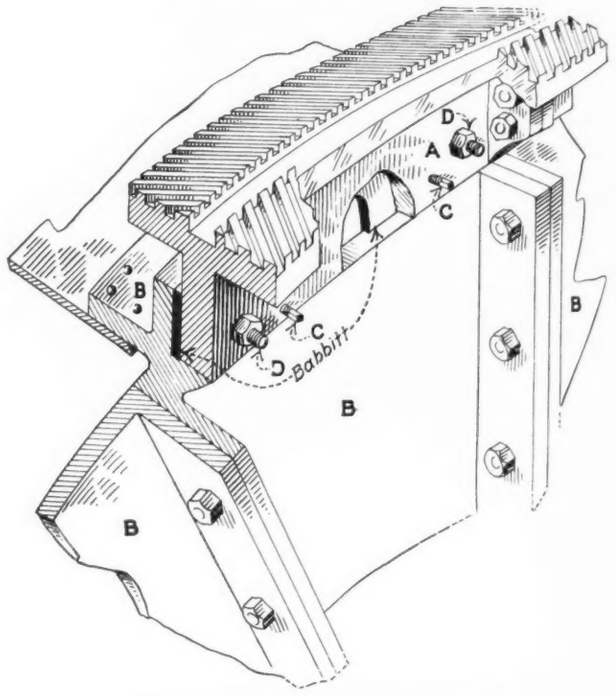
The development of this arrangement has been prompted by the fact that the required amount of lubricant would be used if it is provided in a small container easy to carry and use. The bottle or can type container in common use has proved to be unsatisfactory. They are expensive, uneconomical in use and allow contamination of the contents. It has also been found that containers are often left too near the blast, along with other more rugged accessories, and are frequently damaged beyond repair. Any oil or grease left in such a container at the end of the shift is likely to be rendered unfit for further use. It is believed that the plan of providing a new, clean paper container at the beginning of each shift will lead to better results.

Inefficient operation and breakdowns of drilling equipment are caused to a considerable extent by insufficient lubrication, in spite of the fact that every operator provides an abundance of lubricants and urges their use freely. Present-day miners are not particular about taking care of accessories and the provision of a filled lubricant container that is easy to carry and convenient to use results in better care of the machines.

Alignment of a Herringbone Gear on a Tube Mill

By Phil Lauzon

A herringbone gear, approximately 8 ft. in diameter, was causing trouble in the operation of a 6x14-ft. tube mill. The mill had been sectionalized for mule-back transportation and had been assembled in the field several thousand miles from the place of manufacture. Through lack of care in fabrication or in the assembly, the end segments, shown in the accompanying illustration, *B*, did not form a plane surface to which to bolt the sectionalized gear *A*. If, while the mill revolved, a pencil was held so that the end touched the edge of the gear at its outermost point, at other points there would be ⅜-in. clearance between the gear and pencil. This amount of lateral motion, or "wabble," would have been bad enough in the case of spur gears,



Alignment of a herringbone gear

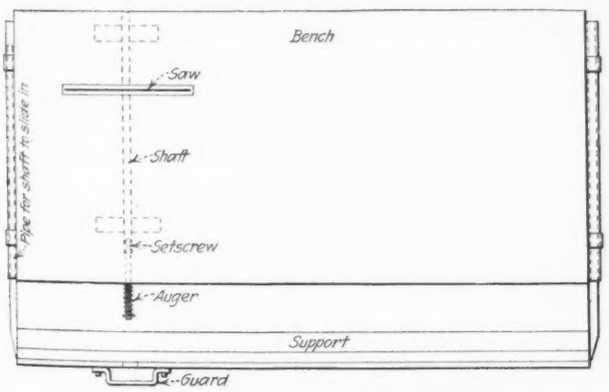
but in the herringbone gears it caused end-thrust in the pinion shaft, which resulted in lateral movement of the Pelton wheel driving the mill, and also caused a disagreeable noise. The gear was wearing rapidly, and since the cost of the gear was well over $1,000, the rapid wear became a serious item, necessitating that something be done to stop it.

When a new gear was to be put on, it was decided to try to improve the mechanical conditions, and holes were drilled and tapped in the web of the gear for ⅝-in. set screw as shown at *C*. The gear was assembled on the mill. The mill was then revolved by prying with crowbars and measurements were carefully made between the edge of the gear and a punch mark on a convenient pinion shaft bearing. At the points farthest from the mark the nuts *D* were loosened and the set screws *C* tightened. As the screws were tightened, the points bearing against the end of the mill forced the gear out, away from the mill. By this means—or vice versa, by loosening the set screws and tightening the bolts—the gear was finally brought into line. Care was taken that there was at least 1/16 in. between the face of the piece *B* and the flange of the gear. Babbitt was poured in this space, after the gear had been heated with a kerosene torch. The space was sufficient to allow the babbitt to flow and fill the opening before it chilled. Removing the set screws, tightening the nuts *D* and putting the gear and pinion into mesh completed the repair job.

Device for Drilling Ladder Stock

By A. A. Gustafson

By drilling the shaft of a circular saw so that the shank of an auger can be inserted and fastened with a set screw, a handy borer is made available. To handle ladder stock and to enable material to be held firmly



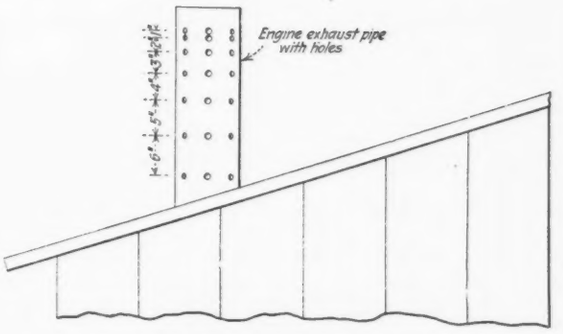
Auger attachment on saw bench

while boring, a support is arranged at the side of the saw bench, as shown in the accompanying illustration. The support is attached to pieces of light shafting on either end. These slide into two lengths of pipe fastened to the end of the bench. The sliding support gives easy control over the work.

Muffler Exhaust Pipe

By Charles Labbe

To remedy a noisy exhaust from a gas or oil engine where a muffler pit is inconvenient to construct, the exhaust pipe is changed to a size larger than that provided with the engine. Where the pipe extends through the roof or side of the building, a series of holes are bored in the pipe, as shown in the accompanying illustration. The holes should be from ⅝ to ¾ in. in diameter and should be placed at intervals around the pipe, the second row spaced 6 in. from the first; the third 5 in. from the second, and the succeeding rows at 4, 3, 2 and 1 in. apart. The result is a gradual decrease of pressure and a reduction in the noise that the exhaust makes.



Muffler exhaust pipe

Preparation of Primers

At the United Verde mine a simple rig has been arranged for the cutting of fuse to the proper lengths and crimping the caps in place. The work bench is provided with a heavy cutting knife operated by levers and a foot pedal. A number of fuse lengths are cut simultaneously. The knife blade is 2 ft. in length and is made from a piece of steel ¼x4 in. in section ground to a cutting edge. The table height is 40 in. The arrangement is shown in Fig. 1. The bench type of crimper, made by the California Cap Co., is used for crimping the caps upon the fuse. This little machine has proved especially efficacious. One man cuts and caps all the fuse for the open pit and underground work. He averages 2,500 primers per day. The blasting caps, used in about equal proportion, are 6X and 8X. The fuse lengths are 4, 5 and 7 ft. Old carbide cans are lined with heavy roofing paper, which is held in place by crimping the edge of the top down over the paper. Lids are made from the bottoms of carbide cans. These containers, shown in Fig. 2, are used for distributing the primers to various parts of the mine and surface operations.

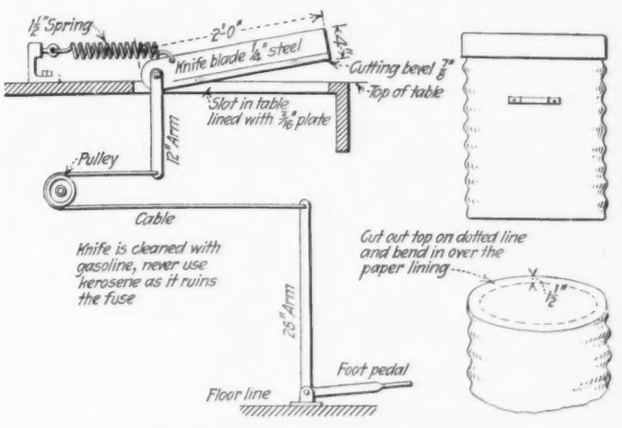


Fig. 1 (left)—Fuse-cutting table. Fig. 2 (right)—Cans for distributing primers

Discussion

Effect of Small Per Cent of Pyrrhotite in Pan Amalgamation

THE EDITOR:

Sir—The following information will be of service to many prospectors and mine-owners. About forty years ago, a silver-gold mine near here was abandoned after being worked for three years. The ore was crushed dry in a twenty-stamp mill and, after roasting, was treated by quicksilver in pans with a loss of about 60 per cent.

As the ore is a clean bluish-white quartz with no base minerals, I sent samples to the Colorado School of Mines at Golden, Colo., asking if the ore required roasting. Reply came that it was necessary to roast for pan amalgamation, also for cyaniding. That puzzled me, and it has also puzzled many metallurgists.

The heavy loss in the old treatment, I found, was due to a small percentage, about ½ of 1 per cent, of rich pyrrhotite in the ore, which, of course, could not be determined by the ordinary wet laboratory tests. The only way I know of finding out is to grind the ore between stones and then use a magnet to show if pyrrhotite is present.

Thanks to the researches of metallurgists, this ore, which could not be treated forty years ago, can now be floated with 95 per cent extraction.

There may be many mill-owners who get a poor extraction from their plant owing to a very small percentage of pyrrhotite in the ore which they do not know about. This is the first time during forty years prospecting that I have come across pyrrhotite at the surface in a silver-gold vein, the matrix of which is quartz, the silver argentite, and no base minerals except pyrite at a depth of 400 ft. Is it not unusual?

Mazatlan, Sinaloa, Mexico. AN OLD PROSPECTOR.

Foreign Versus Domestic Fluorspar

THE EDITOR:

Sir—Your editorial on fluorspar in the issue of June 27 was much to the point. Foreign spar is ruining the domestic industry. This foreign spar is produced with cheap labor and is shipped at ballast rates across the Atlantic. It offers a glaring example of unfair competition. American producers must pay the high wages necessary to the American standard of living, and, furthermore, to reach their market they must pay railroad rates that are more than double pre-war rates.

The foreign producers have been and are exploiting the American market. The figures of importation tell the story: 1921, 5,562 tons; 1922, 29,551; 1923, 37,396; and 1924, 45,574 tons. In the first quarter of 1925 imports were 13,833 tons.

But meanwhile there is growing distress in the spar fields in western Kentucky and southern Illinois. We cannot mine spar cheaply enough to meet this foreign competition. We have invested a very great sum of money in developing spar mines, and all the capital so invested is in jeopardy. Most of the mines are idle.

No man objects to fair competition. But the European competition in spar is manifestly unfair to America. And with a good protective tariff in working order it seems to me that the present deplorable condition of affairs should not be allowed to continue.

Cincinnati, Ohio. JAMES A. GREEN.

Engineer Peak

THE EDITOR:

Sir—I am very much interested in an article written by Walter Harvey Weed on the veindikes of the Engineer mine. I know this country quite well, having been one of those originally interested in the Engineer and am now interested in a property adjoining it.

There is no Engineer peak or Engineer mountain in that country. There is a Gleanor mountain, on which the Gleanor and the Engineer mines are situated. The name of this mountain is registered, and you will find it so called in all reports issued by the Canadian Government. Mr. Weed is evidently at fault when he calls it Engineer peak, because there is no such peak.

Vancouver, B. C., Canada. DONALD CRAMER.

Consultation

Extraction of Zinc From Sulphide Ores

"Is there any method in use for the extraction of zinc from the sulphide ores, by process of solution? What different methods have been proposed to accomplish this object? What were the solvents proposed in each method? How was the metal to be recovered from the solution in each method?"

It is not customary to leach zinc sulphide ores as such, a preliminary roasting treatment being given. The process used at Anaconda and Trail, which together produce most of the electrolytic zinc made in this country, embodies roasting to zinc oxide and sulphate, dissolving in weak sulphuric acid, purifying the solution, and electrolytic precipitation, using lead anodes and aluminum cathodes. This is the most common method of procedure, although Brunner, Mond & Co. in England leach the roasted sulphide ore in hydrochloric acid and precipitate electrolytically from a zinc chloride solution using carbon anodes.

The Sulphating or Coolbaugh process is in use by the American Smelting & Refining Co. at Durango, Colo., for treating lead-zinc sulphide ores. The zinc sulphide is roasted to the sulphate, leached in water, filtered from the residue, and the zinc sulphate crystallized out of the solution by means of a spray drier. Electrolytic separation could be used if cheap power were available.

There are several other methods of treating zinc sulphide ores, most of which have not progressed beyond the laboratory stage. One such process has been evolved in Colorado for treating complex ores containing zinc is the so-called Gordon process, which leaches the roasted mineral with "gas-house" liquor containing ammonium compounds and precipitates the zinc as a carbonate, which is then calcined to form zinc oxide.

Reverberatory smelting of lead-zinc ores has also been practiced at two or three plants, the fume being caught in a bag house and subsequently treated to form a lead-zinc oxide pigment.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

MINING OPERATIONS is Utah during first six months of year show large gains over first six months 1924. In some cases production practically doubled.

The silver revaluation conference at Washington ends, giving operators ten days in which to file supplemental briefs, and ten days for the Revenue Bureau to review the taxpayers' pleas.

Anaconda Copper Co. reorganizes its staff of superintendents—promotes men long in the service and recognizes technical training and ability.

Michigan copper mines active in exploratory work with hopes of finding new copper deposits.

Central Copper Co. has 300-hp. Diesel engine in operation and employs 200 men.

Victoria Copper Mining Co., Michigan, after several years shut-down has declared a dividend of 25c. per share.

The Calivada Mining Co., Keeler, Calif., makes first shipment of ore to Midvale.

Mineral leasing act will be administered by the conservation branch of the Geological Survey. Personnel from Bureau of Mines and Geological Survey combined for more effective handling of this work.

Revision of freight rates under Hoch-Smith resolution as an aid to agriculture. May have an opposite effect on mining.

Active prospecting in northwest Ontario by field parties sent out by established mining companies operating at Cobalt and elsewhere.

Search for New Copper Deposits in Michigan

Crosscutting Kearsarge, Calumet and Osceola Lodes

A fairly good start has been made in crosscutting operations in the LaSalle and Cliff lands of the Calumet & Hecla Co., in search of new copper deposits. The LaSalle drift, started at a depth of 300 ft. from an old shaft in the Osceola lode, is in a distance of 500 ft. At Cliff, a crosscut was started at a depth of 150 ft. from an old shaft, and is in 200 ft. The Cliff fissure vein is the principal objective, but it also will cut the Osceola amygdaloid and the Calumet conglomerate.

Franklin's exploratory shaft in the Kearsarge lode is down 308 ft. Sinking is at the rate of 50 ft. per month. Steady progress is being made and there is no trouble with water. The shaft is directly in the vein, which appears to average 14 to 15 ft. in width. Although the copper content of the rock shows some improvement, it is not yet of commercial grade. Another crosscut will be driven at a depth of 500 ft., similar to the one driven from the 250-ft. level to the Wolverine sandstone, to test and check the formation.

At Arcadian Consolidated, the crosscut west from the 1,850-ft. level, driven to reach the old Arcadian lode, is in 209 ft. It has passed through a wide amygdaloid vein about where it was expected the Old Arcadian formation would be cut, but the rock contained little copper. The crosscut is being continued west. Drifting continues north in the 1,250-ft. level, toward the New Baltic shaft. This opening now is approximately 1,300 ft. from the New Arcadian shaft and is in good copper ground. It has about 400 ft. more to go before reaching a point midway between the two shafts, where drifting will be stopped as it was in the 950-ft. level. Connection with these openings will be made from the New Baltic shaft when that unit is equipped with a new hoisting plant.

Central Copper Pushing Development Work

About 200 men are now employed in the program of development and construction work at the Central Copper Co., Dos Cabezas, Ariz. The 300-hp. Diesel engine is now in operation. An expert from the factory has been on the ground for a couple of weeks testing out the machinery. A 200-hp. General Electric motor has just been received and electrification of the property, eliminating as far as possible the compressed air method, is progressing satisfactorily. Plans for a mill are under discussion, also transportation systems both underground and on surface, and the construction of additional housing facilities.

John E. Penberthy, formerly assistant superintendent of the Moctezuma Copper Co., at Nacozari, Sonora, Mexico, has joined the operating staff of the company and will assist General Manager John W. Prout, Jr., in handling operating details.

Increased Activity at Maxville, Mont.

Gold Ore Discovered on Granite Creek, Near Libby

Operations by the Brook Lead Mining Co. at Maxville, Mont., have been increased to two shifts daily and the quantity of ore put through the mill to 100 tons a day, according to a report from the Snow brothers, managers, received by E. D. Little, president.

"The ratio of concentration on the silver-copper-iron ore is 10 to 1, so we are producing 10 tons daily of that grade," Mr. Little said. "The value of the first concentrate produced in this operation was $30 to the ton, but it has been improved as mill adjustments advanced and is now between $30 and $40. Of silver-lead-copper ore we are producing 2 tons daily having a value of $200 to the ton. By August we hope to be on a three-shift basis. On that basis the mill should dress at least 150 tons a day."

J. H. Eby, mining engineer and geologist, reports that an old-time bonanza is promised as the result of a discovery of gold ore of commercial value on the Victor-Empire Mining & Milling Co.'s property on Granite creek, 9 miles southwest of Libby, Mont. A ledge that outcrops on the top of the mountain for 900 ft. has been cut by diamond drilling at a depth of 1,200 ft. At 1,200-ft. depth the drills have disclosed a width of 8 ft., and cuttings from the drill contain $280 in gold to the ton. Further development should make important disclosures.

Six Months Mining in Utah

Recovery of Zinc as Byproduct Amounts to More Than $3,000,000 Per Year for Utah Mines

By Gail Martin
Special Correspondent

THE UTAH MINING INDUSTRY is more prosperous now than in any year since the World War. A study of the record of dividends and production for the first six months of 1925 proves fully the truth of this statement. Shipments are larger, and this condition in turn is reflected in dividend payments, which increased during the first half of 1925 to $6,185,628, as compared with $5,010,788 for the six months of 1924.

In more than one way is this increase significant. It indicates a widespread expansion of the industry rather than unusual prosperity on the part of a few individual producers. Opening of new orebodies has also played its part in this improvement, but perhaps the most important factor has been the founding of a new industry in Utah, the reduction of zinc ores.

Raising the ban on zinc ores permits the exploitation of large tonnages previously not classed as commercial ores. A problem that threatened the prosperity of the industry has been solved successfully. The zinc in the ores is now paid for rather than penalized. Revenues accruing from the zinc industry alone will increase the earnings of Utah mines $3,000,000 annually.

During the last six months, several individual as well as district records have been excelled. Park City mines set a new record by shipping a total of 209,503 tons of ore and concentrates, as compared with 102,900 tons for the similar period of 1924.

Although the output of Tintic mines did not make as phenomenal an increase, more dividends were disbursed than during any similar period for years. This was largely due to the prosperity of Tintic Standard, which paid a total of $1,268,206 during the first half of the year.

In order to treat the rapidly mounting tonnages of zinc-lead ores available, Utah smelters have expended large sums of money in experimentation and in the construction of new plants. The International Smelting Co. is operating the Utah Consolidated Mining Co.'s mill, acquired when the properties and assets of the company were taken over, at its capacity of 1,000 tons daily.

The United States Smelting, Refining & Mining Co. is now erecting a 1,000-ton oil-flotation plant at Midvale, Utah. The Combined Metals Reduction Co., at Bauer, is treating from 150 to 200 tons daily. In a short time the company hopes to have all mechanical difficulties eradicated and the mill operating on a considerably increased basis.

The first six months of 1925 have also been remarkable for expansion of activity on the part of several large companies. The International Smelting Co. has acquired large holdings in the East Tintic district at Eureka, where it has undertaken prospecting with the idea of determining the possibilities of this virgin field.

The Tintic Standard Co. has augmented its holdings by purchasing the property and assets of the Iron Blossom Co. as well as other properties. Exposure of a new orebody in the Mammoth mine, at Eureka, has enabled this company to re-enter the ranks of dividend payers. The Utah Apex mine, at Bingham, has increased its earnings greatly by the finding of new orebodies. Strikes on the lower levels of the mine between the 2,000 and 2,400 have added greatly to the camp's activity. The mine has been producing about 1,000 tons of ore daily. During the first six months of 1925, $300,000 in dividends was paid by the Utah Apex. Last year, no dividends were paid.

Park City mines shipped 209,503 tons of ore during the first half of 1925, as compared with 102,900 tons for a similar period of 1924. The high price of lead, removal by smelters of the ban on zinc ores, and the excellent condition of Park City mines were factors contributing to this record.

The Tintic mines produced 4,507 carloads during the first six months of 1925, as compared with 3,288 carloads for the first half of 1924.

Need of Salt Lake Valley smelters for flux ore and the high price of lead are the main factors in this 37 per cent increase in output. Tintic Standard, with an output of 102,640 tons of ore, is the district's heaviest producer.

Bingham Mines—the Eagle and Blue Bell, and the Victoria—had probably one of the most prosperous half-years in its history. New discoveries in both properties enabled the company to increase its output to 491 carloads, as compared with 264 carloads for the first six months of 1924.

Basically, the Utah metal-mining industry is in excellent condition. Ore reserves of leading producers were never larger. The high price of lead is stimulating the development of prospects and allowing producers a good margin of profit. Successful treatment of zinc ore is bound to play an important part in stimulating production.

Calivada Mining Co. Makes Initial Shipment to Midvale

The Calivada Mining Co., operating the Pete Smith mine, five miles east of Keeler, Calif., recently shipped to the Midvale, Utah, smelter, 25 tons of ore averaging $50 a ton in silver and lead. This ore was extracted on the 150-ft. level from No. 1 vein, which is exposing an orebody varying from 2 to 4 ft. in width. By a deal recently closed, the Calivada company has acquired a half interest in the old Xmas Gift mine, at Darwin, adjoining the Lucky Jim and Defiance properties of the old Darwin Silver Co., which are at present being operated by C. H. Lord and associates of Chicago under a lease and bond.

Victoria Copper Declares Dividend

The Victoria Copper Mining Co., whose property has been shut down for several years, has declared a dividend of 25c. per share, payable Aug. 19. Of the Ontonagon County mines, in the Michigan copper district, Victoria is the most likely to resume operations under favorable metal market conditions. When Victoria closed down, its rock was averaging about 18 lb. of copper per ton and mineralization was increasing with depth. Machinery and all other equipment at the mine are in good condition and operations could be resumed on short notice. Under present methods of close selection, Victoria's yield no doubt could be brought up considerably, as this has been the experience of every producing mine in the district. Victoria is one of the best-equipped properties at the Lake. It has its own stamp mill and is favored with cheap power, provided by a water-power plant capable of developing 5,000 hp. under full head of water. The mine is comparatively dry and the work of unwatering the shafts could be done in a short time.

Tests Reveal Good Zinc Ore on Snake River, Idaho

E. T. Ettershank, owner of a zinc mine prospect on the upper Snake River thirty-four miles from Lewiston, Idaho, has completed a test of a small quantity of the ore that showed a zinc content of more than 25 per cent. The tests were made at the Garver ore-testing plant in Clarkston, Mont. Portland and other mining men have been in touch with the owner. The prospect has been opened by a 150-ft. tunnel disclosing a vein 8 ft. wide. This is the first zinc prospect reported from the Snake River district, the ledge extending virtually to the river's edge.

New Development Started on Soldier Canyon Mine

Development has been resumed on one of the oldest groups of mining claims in Utah, the property of the Soldier Canyon Lead-Silver Mining Co., situated in the Stockton mining district twelve miles south of Tooele. Utah's mining history dates from 1862, when General Connor's soldiers stationed at Fort Douglas discovered the first ore at Bingham. The first claim, the West Jordan, now belonging to the United States mine, was located in 1863.

The company is driving a tunnel to cut at a depth varying from 400 to 800 ft. the fissures exploited by the soldier-miners. Samples from surface showings contain 17 to 40 oz. in silver to the ton and 52 to 77 per cent lead.

Buy Mill; Start Prospect Drift

R. L. Kidner and associates have purchased the Silver Fox mill and lease, located near Treece, Kan., in the Joplin-Miami district, and have started a prospect drift toward the northern boundary of the property, where the Big Elk company opened a field shaft some time ago.

Swansea Mining Co. Defendant in Mining Suit in Yuma County

One of the largest civil suits ever filed in Yuma County has been started by the Swansea Lease, Inc., against the Swansea Consolidated Gold & Copper Co. and the Hellman Commercial Trust and Savings Bank of Los Angeles for $234,322.59. The complaint alleges this sum is due on account of a trust deed given for the mining property, the payment of state and county taxes, and for mutual and current accounts between parties.

Miami Rock-Drill Contest Won by Beaver Team

Wolfe and Osburne, Winners, Used Gilman Drill—Time Slow on Account of Low Air Pressure

At the Imaim Amohalko fiesta held at Miami, Okla., on June 3, a holiday crowd of 10,000 saw A. J. Wolfe and C. C. Osburne drill through an 8-ft. block of concrete in 4 min. 1 sec. The occasion was a rock-drilling contest in which ten two-man teams participated; the winners represented the Beaver mine of the Commerce Mining & Royalty Co. The fact that the time was slow as compared with that of last year is accounted for by the lower air and water pressure. At times during the recent contest the air dropped to as low as 80 lb. while the machines were in operation. It is believed that with an adequate water pressure faster time could have been made.

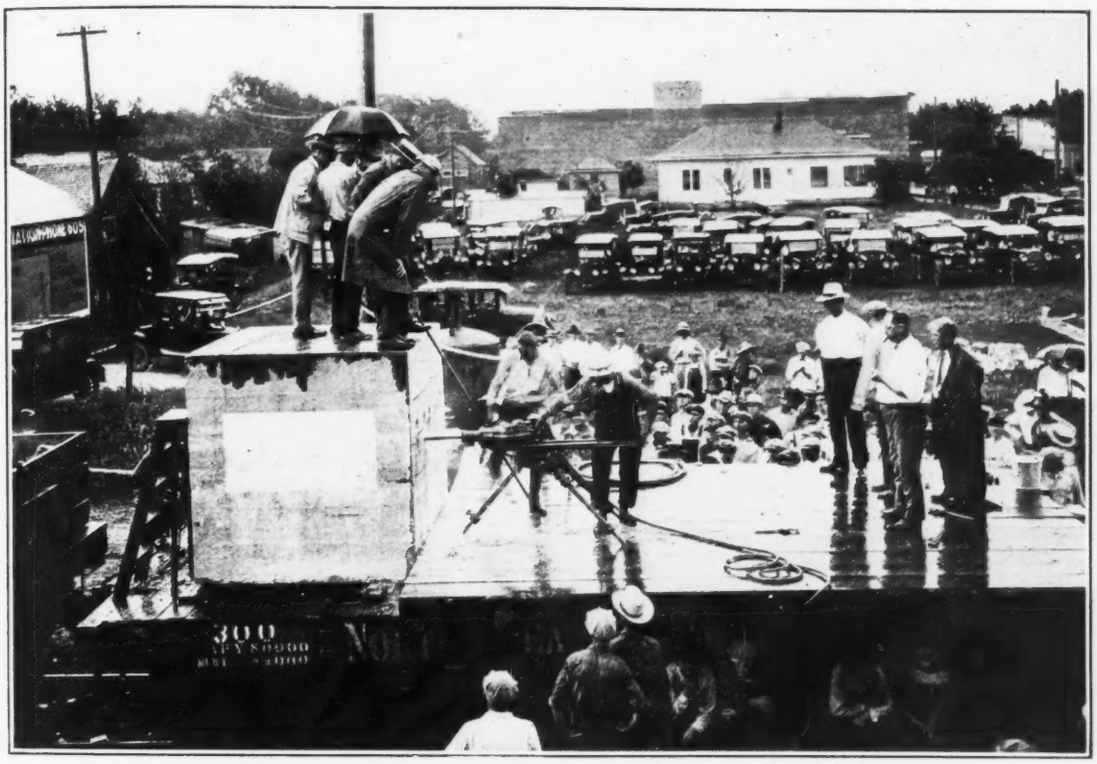
The stipulations of the contest required that each team carry the drilling machine a given distance, mount it upon a tripod and drill through the concrete block, after which the machine was to be removed from the tripod and both placed in their original position.

The Beaver team used a Gilman heavy drifter type of hammer drill. Second place was won by Kissinger and White in 4 min. 34 sec. and third by Coulter and Richman in 4 min. 35 sec.

New Developments in the Star Mine, Cherry Creek, Nev.

J. W. Walker and associates are developing the old Star mine at Cherry Creek, Nevada. It is reported that in a crosscut off the main tunnel level a rich vein has been discovered, which is believed to be the faulted segment of the orebody so productive in the early days.

The ledge is 3 to 4 ft. wide and averages about 100 oz. silver to the ton. A shipment of ore averaging 150 oz. to the ton has been mined from the strike.



Rock-drilling contest at Miami, Okla., showing drill in operation

Park-Utah Absorption of Park City M. & S. Complete

In Park City, the Park-Utah Mining Co. has taken over the property and assets of the Park City Mining & Smelting Co. By this step, the Park-Utah company, which will henceforward be called the Park-Utah Consolidated Mines Co., starts its augmented activities with net quick assets of considerably more than $2,220,000.

Exchange of shares of the Park City Mining & Smelting Co. stock for that of the Park-Utah Consolidated Mines Co. is now going on. Basis of exchange is one share of Park City stock for one share of the Park-Utah. Only shareholders of the Park City Mining & Smelting Co. need send in their stock to the company's Salt Lake offices, since stock of the Park-Utah Mining Co. is still valid. The charter of this company was merely amended to change the name to the Park-Utah Consolidated Mines Co. and to increase the capitalization to 2,500,000 shares. The next step in the Park City merger will be to acquire the Ontario and Daly mines, control of which is held by the Park-Utah Consolidated Mines Co.

Silver Dyke Resumes

Operations of the Silver Dyke mine and mill at Neihart, Mont., have been resumed since the breaking of a tailings dam and damage to the water supply by the earthquake. The water system has also been repaired.

Florence Mining Co. Undergoing Reorganization

F. R. Wolfle of Spokane, president of the Florence Lead-Silver Mining Co., says in a circular letter that the new corporation is being organized to take over the Florence mine at Ainsworth, B. C.

"The new company will accept the offer of the judgment holders to take over the property for $160,000," Mr. Wolfle states. "Acceptance of the offer and the payment of this sum will give our company a clear title to the property, valued at $1,000,000.

"The value of the lead-silver concentrates should be $110 a ton at current prices for these metals. With the electrical equipment which the company will install, operations may be continuous instead of intermittent, as with the present equipment.

"The improvements necessary to this efficiency will cost $30,000, of which $15,000 will be for mill equipment, $10,000 for mine equipment, and about $5,000 for our share of the power line construction. At the increased rate of production, we should be able to cancel the obligation in less than a year."

Anaconda Reorganizes Superintendents' Staff at Butte

Seven Groups of Mines Instead of Four—Promotions for Men Long in Service—More Effective Supervision

REGROUPING of the Anaconda Copper Mining Co.'s twenty-five mines at Butte, Mont., with the creation of three new assistant superintendencies has been announced by J. R. Hobbins, vice-president in charge of operations. This step is a measure for increased operating efficiency to result from closer supervision on the part of a group superintendent, and is in line with Mr. Hobbins' plans for further cutting costs of production at Butte. The men who will fill the new posts are promoted from their present positions, and further promotions are made all along the line.

The organization of the operating department of the company is unchanged. All assistant general superintendents report, as heretofore, to William B. Daly, manager of mines, and Chauncey L. Berrien, general superintendent of mines.

A brief sketch of the records of the new assistant superintendents, all of whom, incidentally, are college graduates, is given in the Anaconda *Standard:*

Ed G. Kane, advanced from the foremanship of the Diamond to assistant general superintendent, is a Butte boy who comes of a mining family. His father, the late John P. Kane, was for many years foreman of Butte properties, including the St. Lawrence and the Minnie Healy. His uncle, Paddy Kane, was at one time a general superintendent of mines. Mr. Kane was born in Butte thirty-seven years ago. He attended parochial schools and in 1906 entered the Montana State School of Mines, from which he graduated with a mining engineer's degree in 1909. He at once entered the engineering department of the Anaconda company, where he remained for five years, going to the Diamond mine in 1914 as assistant foreman. In 1917, during the administration of William H. Maloney as Mayor, Mr. Kane took the office of city engineer, serving about two months, when he was appointed foreman of the Diamond, a position he has since held. He is married and has two boys.

A. E. Blair, promoted from foreman of the West Colusa to assistant general superintendent, has been mining in Butte for twenty-five years. He went there in 1900, two years after graduating from the Michigan College of Mines at Houghton, and went to work at the West Colusa as a miner. Later he entered the engineering office of the old Boston & Montana Co., and was in that department for a number of years. Then he was sent to the West Colusa as assistant foreman under Carl Krueger, succeeding to the foremanship in 1921. During the time he was with the Boston & Montana he did surveying for all the properties in that mining group. Mr. Blair is a native of Wisconsin, but most of his life has been spent in Montana. His family moved from the Badger state to Colorado and in 1889 to Granite, Mont., where Mr. Blair worked for some time in the silver mines when that place was a flourishing mining camp. In 1893 Mr. Blair went to Houghton and entered the School of Mines, graduating in 1898. He spent a couple of years at Granite and then went to Butte.

Hal J. Rahilly, promoted to assistant general superintendent from the foremanship of the Tramway mine, is a native of Minnesota and a graduate of the university of that state. He was born in 1889 and, after finishing his university work in 1911, Mr. Rahilly became associated with the Oliver Iron Mining Co. of Duluth and other concerns in the iron range. About two years later he removed to Bisbee, Ariz., to take a position with the Calumet & Arizona Copper Co. After one year in the Arizona copper camp, Mr. Rahilly went into old Mexico and spent three years in the employ of the Archipelego Mining Co. After returning to this country, Mr. Rahilly accepted a position with the U. S. Bureau of Mines and spent two years in Alaska and Pittsburgh. He was then transferred with a promotion to Billings and given charge of the bureau's work in five states, with headquarters at Billings. In 1917 he resigned his connection with the government to take charge of fire-filling operations for the Anaconda company at the West Colusa and Tramway mines. This work was completed about a year ago and on March 1, 1924, Mr. Rahilly became foreman of the Tramway.

Jamison Mine in Plumas County Sold

The Jamison mine in Plumas County, California, near Johnsville, has been reported sold to San Francisco parties under lease and bond. The price is said to have been $70,000, of which $10,000 has been paid.

Ore Shipments Over the T. & N. O. Ry. for June, 1925

(In tons of 2,000 lb.)

Cobalt Proper	Tons
Mining Corporation	685.36
McKinley-Darragh	80.82
Nipissing	87.80
O'Brien	139.25
South Lorrain	
Keeley	83.98
Lorrain Trout Lake	690.40
Mining Corporation (high-grade)	80.00
Mining Corporation (milling ore)	1,531.76
	3,379.37

The above shipments from Cobalt and South Lorrain, Ont., were made as follows:

To Canadian Points:	
Deloro Smelting & Refining Co., Deloro	864.12
Montreal	87.80
Cobalt (for milling)	2,161.58
To United States:	
American Sm. & Refining Co., Tacoma	265.87
	3,379.37

Verde Central Purchases Claims and Ends Litigation

The Verde Central Mines Co., of Jerome, Ariz., has recently purchased the Apex No. 1, 2 and 4, the Butte Extension, and the Nilsson fractions from the Verde Syndicate Copper Co., for approximately $50,000. This group of fractions, located in 1920 by E. Weidman and later turned over by him to the Verde Syndicate, comprises 31.2 acres of ground extending northeast and southwest across the Verde Central property near its center. The purchase ends the apex litigation that has been carried on by the two companies for a number of years. The remaining twelve claims of the Verde Syndicate have been sold to the Verde Central Extension Co., which adjoins the Verde Central on the southwest.

Blind Spring Hill District, Calif., Shows Renewed Activity

A Number of Old Mines Are Being Reopened

Blind Spring Hill, comprising an area about five miles long by three miles wide, thirty miles north of Bishop, Calif., gives promise of renewed activity in the near future.

Foremost among the companies operating on the hill is the Comanche Mining & Reduction Co., controlled and financed by Judge Erskine M. Ross. The Comanche company owns the Comanche, Diana, Kerrick, and several of the other early producers and has resumed their development along modern, comprehensive lines. More than a quarter of a million dollars has been set aside to prosecute operations designed to intersect at depth the many orebodies that made possible the early rich production of the properties now held by the company. Chief interest centers at present in the Comanche shaft. It is being sunk from the 700- to the 800-ft. level, at which depth drifts will be extended 400 ft. north and 200 ft. south. Surveys show that these proposed drifts will give depths on the old Comanche orebodies of 150 ft. below the stopes credited with a production exceeding $4,500,000 from 1873 to 1881. The Kerrick shaft, originally sunk 650 ft., is likewise being deepened. It is nearing the 820-ft. point, with 2 ft. of shipping-grade silver-lead ore exposed in the bottom of the shaft.

Operating under a lease and bond, recently obtained, J. A. Hanford, of Los Angeles, and Frank E. Gilbert, of Borneo, have installed a gasoline hoist and other necessary equipment on the old Boraska mine on Blind Spring Hill. It adjoins the Comanche on the southwest and the Lyford mine on the north and west. The new operators are sinking the Powell shaft on the Boraska mining claim from the 300- to the 500-ft. level.

Asa Young, of Oakland, Calif., has resumed operations on his "Come-Back" property, adjoining the Boraska mine on the southeast. He is extending a crosscut tunnel 120 ft. from the end of which a raise will be run in an endeavor to cut three veins containing silver and lead.

News From Washington

By PAUL WOOTON
Special Correspondent

Question of "Revaluation" of Silver Mines for Tax Purposes Still in Abeyance

Producers to Submit Additional Briefs Within Ten Days—Decision Probably Due in August

NEITHER SIDE to the controversy as to the proper procedure in evaluating silver mines for tax purposes was willing to modify its position in any way after extended discussion of the matter before the Commissioner of Internal Revenue. The producers of silver were given every opportunity to present their views, but it was apparent that they made no headway toward convincing the bureau's engineers that their contentions are inequitable. The metals valuation section takes the position that what is fair for copper, for lead, and for zinc is fair for silver, but the attempts to justify their position, in turn, made little impression on the silver producers. One thing is certain, Commissioner Blair will have a complete explanation of each side of the case before him for study. He will have the stenographic record of everything said at the hearing. In addition, he requested the producers to submit a brief summarizing their evidence. This is to be presented within ten days. Ten days then will be allowed the engineering division to make its study of the producers' brief and make its reply.

Unless it should be found necessary to extend the time for the submission of briefs it is probable that the Commissioner's decision in the matter may be expected by the middle of August, as it is the intention of Commissioner Blair to settle the matter as quickly as possible.

Should the Commissioner overrule the engineering division in this matter, as many believe he will do, it probably then would mean the reorganization of that subdivision of his bureau. The importance attached to the revaluation question is indicated by the presence at the hearings of Assistant Secretary of the Treasury Moss.

The hearings were not public and Internal Revenue officials have agreed not to comment on them. It is pointed out that much information had to be developed as to the situation at individual properties and for that reason as well as others the record of the meetings will not be made public. The producers likewise agreed to make no statements except through a committee, and it has seen fit to release very little material.

It was revealed that H. B. Fernald, of New York, had challenged the statement submitted by the engineering division, published in full in these columns last week, on the ground that it was not germane. It was his opinion that the object of the hearing is to determine whether or not revaluation should be undertaken. If it should be decided that revaluation is necessary, it then would be the time, he declared, to consider the formula under which it would be conducted. He attacked the formula submitted as being unsound and incomplete.

Broadly speaking, the contention of the producers is that it would be unjust to reopen tax cases already settled and that existing methods of valuation are equitable to all concerned. No legal authority for the revaluation exists, it was contended, and even if undertaken would be only an arbitrary determination which, according to J. W. Wade, of Utah, could but have the effect of stifling the development of new orebodies and interfere with the mining and marketing of ore.

Authority of Bureau Questioned

To carry into effect the proposals of the engineering division, it was declared, would exceed any authority vested in the bureau and would make necessary the monumental task of reauditing an industry. To plunge silver production into the uncertainties of new tax liabilities would dry up sources of new capital on which the industry depends and is unfair to the widely diversified ownership of existing properties, Commissioner Blair was told by M. W. Kreigh, chief of the tax division of the American Mining Congress. He indicated that the case might be carried to the courts were the Commissioner to sustain the minerals valuation section. "It is not in the public interest," he declared, "to have the affairs of a great industry confused and made unstable by compelling it to resort to litigation to protect its rights."

Mexican Metal Exports Show an Increase

Exports of metals through the port of Tampico, Mexico, showed a considerable increase during the month of June over the preceding month. The largest movement was that of lead, which aggregated 11,890 tons. Zinc concentrates came next, with a total of approximately 10,000 tons. Copper exports through Tampico amounted to 950 tons; of silver, nine tons. A total of 721 tons of arsenic produced at the plants of the American Smelting & Refining Co. was exported. For the first time in several years quicksilver is again being exported from Mexico in what promises to be increasing quantities. During last month the movement of this metal through Tampico amounted to 600 kilos. This quicksilver was produced by the Mexican Corporation at its cinnabar mine near Zacatecas.

Conservation Branch of Survey Will Supervise Mineral Leasing

Closer Supervision Made Possible by Regrouping

Transfer from the Bureau of Mines to the Geological Survey of the administrative duties in connection with the general leasing act has made necessary the enlargement of the Survey's land classification branch, which in the future will be known as the conservation branch. Herman Stabler will be chief of the enlarged unit and J. D. Northrop assistant chief of the branch. The technical and engineering activities will be co-ordinated through an advisory board composed of J. D. Northrop, F. B. Tough, H. I. Smith, W. G. Hoyt, A. E. Aldous, and G. W. Holland. The conservation branch will be divided into four divisions, mineral leasing, mineral classification, homesteads, and power.

The work of the mineral leasing division will consist of the supervision of the scientific and technical phases of public land operations, including prospecting permits and leases under the general and potash leasing laws. It will perform certain functions with respect to leasing operations on petroleum reserves, and on Indian lands.

The work of the mineral classification division is to consist of examining and of classifying the public lands with respect to their mineral resources. Advisory reports on the mineral value and the geologic structure will be made.

The transfer of mineral leasing supervision permits a new lineup of the activities of the Interior Department in promoting the development of the public domain. In a statement with regard to the new organization, George Otis Smith, director of the Geological Survey, says:

"Although classification of the public lands was a specific duty laid on the director of the Geological Survey in the organic law of 1879, it was regarded at that time as impracticable to execute a classification of lands in advance of sale, but instead scientific study of the national domain was started with the purpose of helping farmers, miners, lumbermen, and engineers in their industrial operations. The examination of the areas under survey was to be thorough and scientific and its aim was to promote and guide development by showing the practical values of the land in terms of wise use.

"Thirty years later, settlement had increased the population of the West more than fivefold and the impelling motive in public land administration naturally came to be wise utilization of the remaining government lands rather than their rapid disposal, with land classification as the dominant item in the business policy of handling the real estate of Uncle Sam.

"Beginning about 1909, public land legislation has expressed the principle of relative worth by seeking the best utilization of water powers, the conservation of flood waters, the reservation of coal lands from agricultural entry, the protection of the oil industry from itself by discouraging production in ad-

vance of possible needs. All these efforts toward wiser use of the great natural resources of the West were made by the federal government in its capacity as the largest landowner.

"Laws based on the determination of the character of the land and the extent of its resources, passed in the last fifteen years, have required the further extension of technical and scientific work into the field of land administration."

The protection of the public estate, the guidance of the development of its resources, and the promotion of wise use of the products of the national domain are practical objects, all summed up in the one word—conservation. So it is that to the land classification activities of the Geological Survey are now added the supervision of the leasing of the oil, coal, and other minerals on the public and Indian lands. The two types of work are closely related and have had some informal connection in the past, but now they may be directly co-ordinated so that the oil geologist and the oil engineer, for example, will work in close contact on their common problem of wise administration of the resources in public ownership.

French Producers Continue Entente for Price Control

The French entente for the control of domestic prices on iron and steel has been extended until July 30 pending the conclusion of negotiations for a new entente to cover the period of one year, Commercial Attaché Chester Lloyd Jones, Paris, cables the Department of Commerce. The new entente among the French producers of pig iron has been virtually concluded, but the entente among the steel manufacturers is less advanced.

Although the Franco-German commercial negotiations have adjourned to Sept. 15, the private negotiations for an accord on metallurgical products, which have been going on at Düsseldorf, will not be terminated, but will be resumed at the close of July.

Production during the month of May advanced somewhat, 706,000 metric tons of pig iron and 596,000 tons of steel ingots and castings having been turned out. This compared with an output of 686,000 tons of pig iron and 587,000 tons of steel ingots and castings in April. On June 1 there were in France 141 blast furnaces in operation, 32 furnaces ready to operate, and 47 furnaces under construction or repair.

Andalusite Found Near Mayer

Much excitement has been caused by the recent location of a number of andalusite deposits by a large Eastern corporation in the Mayer section of Arizona.

Andalusite is a silicate of aluminum and has many uses as a refractory. It is particularly adapted to the making of spark plugs and other electrical apparatus in which extreme dielectric strength is required. It is understood that plans for the development of the property are under way.

Revision of Freight Rates Under Hoch-Smith Resolution

Reduction of Freight on Agricultural Products May Increase Rates on Ore Shipments

Action of the Interstate Commerce Commission in combining the consideration of proposed increases in Western rates with the general rate structure investigation has caused apprehension among Western shippers of commodities other than the products of agriculture. The Hoch-Smith resolution of the last Congress specifically directs that, in view of the depression in agriculture, the commission shall effect such lawful changes in the rate structure of the country as will promote the freedom of movement by common carriers of the products of agriculture affected by that depression, including livestock, at the lowest possible rates compatible with the maintenance of adequate transportation service.

The commission has decided to hear the two cases jointly. The initial hearing will be held in Chicago Sept. 1. An effort will be made first to determine what products of agriculture, including livestock, in the Western district are affected by depression. The commission then will try to determine what, if any, reductions may be effected lawfully in the rates or charges on the products of agriculture. Next it will determine whether any rates, fares, or charges, either on particular classes and kinds of commodities, or classes of traffic, in particular sections, or between particular localities in the Western district, or otherwise, may be increased, and if so, to what extent, in order to compensate for such rate reductions, if any, as may be found proper.

Since the Hoch-Smith resolution has behind it all of the influence of the agricultural industry, shippers of mineral and manufactured products fear that an attempt may be made to shift a larger proportion of railroad revenues on to their shoulders.

Bureau of Mines Advisory Committee Not Yet Complete

To comply with a request from J. Edgar Pew, president of the American Petroleum Institute, it is probable that no meeting of the Bureau of Mines advisory committee will be held until the end of the month. Mr. Pew has designated D. M. Folsom, of San Francisco, to represent the Petroleum Institute on the committee. He has asked particularly that sufficient time be given for him to come East to attend. As this is written, no call for a meeting of the committee has been issued, but it is expected that Chairman Reynders will comply with Mr. Pugh's request.

C. P. White, the coal specialist on Secretary Hoover's staff, will act as secretary to the advisory committee. The selection of Mr. White is regarded as having added materially to the strength of the committee. Mr. White is a retired coal operator who believes successful men have an obligation to the state which can be discharged by undertaking public service. His handling of the coal situation in the Northwest and arranging for Canadian supplies during the war is regarded as one of the most striking pieces of administrative generalship of that strenuous period. His acquaintanceship with industry and his ability as an organizer will stand the advisory committee in good stead, it is believed.

In addition to the naming of a member for the Petroleum Institute, the Iron and Steel Institute has been asked to name a member. It is probable that the committee will be expanded further, as much pressure to that end already is being exerted. The difficulty in assembling a large committee with its membership drawn from different parts of the country makes it seem probable that much of the work will be done by a small sub-committee, which can spend most of its time in Washington. It probably will be necessary to afford hearings to some interests not in accord with some phases of the bureau's present work. Such a sub-committee would be able to reduce to their essentials all matters coming before the committee, so that the committee itself could reach its decisions without undue consumption of time.

Active Prospecting in Northwest Ontario

Prospectors in large numbers are going into the Patricia district, the farthest northwestern portion of Ontario, which embraces about one-third of the total area of the province, lying north and west of the Albany River and James Bay, extending to the Manitoba boundary. The character of the rocks, with the occurrence of the pre-Cambrian formation, gives reason to expect the discovery of valuable mineral deposits. A report by the late Willet G. Miller, provincial geologist, some years ago expressed the opinion that the Keewatin rocks should contain deposits of gold, iron, and other metals. One of the chief objectives at present is to trace out the formation which extends from Bulldog Lake, Man., across the boundary into Ontario. Recent reports are to the effect that these formations have already been located and some large veins discovered, on which prospecting operations are now in progress. Among the prospectors in the field are parties sent out by the Hollinger Consolidated, Dome Mines, Nipissing, Huronian Belt and other mining companies.

Alaska Juneau Production in June

In June, 1925, the Alaska Juneau Gold Mining Co. mined and trammed to its mill 294,100 tons. Total recovery was $165,600, or 56.31c. per ton; operating expenditures were $145,500, or 49.47c. per ton, leaving an operating profit of $20,100 or 6.84c. per ton. Other expenditures and accrued charges totaled $34,750, leaving a deficit of $14,650 for the month. Additions to milling plant are about 45 per cent completed and Ebner preparatory work about 44 per cent completed.

Melbourne Letter

By Peter G. Tait

Special Correspondent

Hampton Celebration, Ltd., Under New Management

Silver-Lead Deposits at Mount Isa Basis for Important New Mining Field in Australia

Melbourne, June 16—The Hampton Celebration, Ltd., which was the mine that started the boom on the Hampton Plains field several years ago, is to be reopened as the result of a favorable report by H. E. Vail, manager of the Lake View and Star mines, Kalgoorlie. The shaft is to be sunk another 200 ft. from the 400-ft. level.

The New Guinea Copper Mines, Ltd., in Papua, is gradually getting back to normal. The trouble with the blowing plant at the furnaces which was followed by the fire in the Laloki mine toward the end of last year, upset the program. No ore could be hoisted from the Laloki mine and an open cut was started as a temporary expedient. In order to maintain supplies for the smelters, larger quantities of ore were mined from the Dubuna mine. Trouble with the converting plant has also limited the output, and 5,000 tons of matte has been shipped to Port Kembla for treatment. However, it is expected that in the near future the company will convert all this matte and produce 10 to 12 tons of blister copper per day.

Considerable interest is manifested in the development of the Thompson suction cutter dredges. Several of these plants have been installed in Australia, but the majority are being shipped to the Malay States, where eleven plants are either in operation or in course of erection. There have been the usual initial troubles in bringing these plants to the full production stage and one company went so far as to take advantage of its option to reject the plant. However, the manufacturers have entered into an agreement with the company to operate the dredge at their own expense in order to demonstrate its capacity, which they claim is between 80,000 and 100,000 cu.yd. monthly at a cost of 2s. 8d. per yard, a considerable saving over the cost with a bucket dredge.

The negotiations for the amalgamation of the copper mines in the Cloncurry district have broken down so far as the proposal to amalgamate the Mount Elliott and Hampden-Cloncurry group is concerned. This is unfortunate, as it is believed that the hope for the field lies in the erection of a large central treatment plant. It is now announced that the Mount Elliott company intends to acquire the Mount Cuthbert group of mines. The Mount Cuthbert company, although it possessed considerable ore reserves and a modern furnace plant, has for years been in financial difficulty and is now in liquidation, the property having been purchased a few months ago by Brandeis, Goldschmidt & Co. It is understood that the Mount Elliott company will now erect at Cloncurry the first unit of a plant to produce electrolytic copper direct from the ore by roasting, leaching, and electrolysis.

The new silver-lead field at Mount Isa is still attracting considerable attention. The chief geologist of Queensland, B. Dunstan, is reported to have stated that the four principal mines have reserves of 4,246,000 tons averaging 10 per cent lead and 3.2 oz. silver. The average silver-lead contained in Broken Hill ore is in the neighborhood of 12 per cent lead and 7 oz. silver per ton, but in this case there are large orebodies, whereas the Mount Isa deposits are in small veinlets. It is one thing to estimate huge tonnages but quite another to treat them at a profit. At this stage it appears certain that Mount Isa is not a field for small companies and that operations will have to be conducted on a large scale. The first essential is the construction of 52 miles of railway at an estimated cost of more than £300,000, and the second is to provide a suitable water supply. At present there is hardly sufficient water available for domestic purposes. Australia needs a new mining field and if the capital is forthcoming to develop Mount Isa, it may lead to the establishment of an important mining center.

Mexico Leading Silver Producer —Second in Lead

Mexico continues to hold its place as the leading silver-producing country, the Mexican Embassy in Washington contends in an official statement. The southern republic ranks second among the lead-producing countries and fourth as a producer of both gold and copper. These claims are based on 1923 figures compiled by the Mexican Government. These show the 1923 production of silver to have been 6,214,118 lb. Lead production totaled 342,584,752 lb.; gold, 637,877 oz.; copper, 117,417,480 lb.; zinc ores, 41,819 metric tons; quicksilver, 98,452 lb.

Labor Difficulties in Belgium

The Belgian Government has announced that a large deficit will be incurred during the current year, according to cable advices to the Department of Commerce. The labor difficulties in the metallurgical and construction industries have become more serious, with no indications of a settlement. Reparations coal deliveries during June amounted to 241,000 tons, increasing the existing coal crisis resulting from overproduction and accumulation of stocks. Copper production in the Belgian Congo appears to be increasing steadily. The recent downward tendency in the cost of living has apparently stopped.

Fraud Charge Against Joseph Myers, Bingo Mine, Dropped

The three charges of fraud remaining to be heard against Joseph Myers, managing director of the Bingo mine, at the Winnipeg Police Court were dropped on July 14, when R. B. Graham, crown prosecutor, announced that a stay of proceedings had been entered. He stated that a direct charge might be laid later in the Assize Court.

London Letter

By W. A. Doman

Special Correspondent

Encouraging Report on Platinum Deposits in Transvaal

Labor Shortage at West African Mines to Be Offset by Introduction of Jackhammer Drills

London, July 7—Stephen J. Lett, a London mining geologist, has made an exhaustive investigation of one of the farms in the Waterberg district of the Transvaal for a local company, the Doornhoek Platinum Mines, that has been prospecting the property for platinum. During his examination he took eighty-seven samples and completed an assay plan of the lode exposures, and he has advised the owners of the farm that the prospects of finding a paying deposit of platinum on Doornhoek farm are encouraging.

Shareholders in the Porcupine Goldfields Development & Finance Co., Ltd., are getting restless at the delay in issuing the official statement regarding the situation. This was promised at the end of May. Negotiations apparently are continuing. It is suggested that the capital is to be reorganized and further funds raised to test certain parts of the property.

Relatively little interest has been taken in the Gold Mining Co., Ltd. (Rhodesia), of late, but there is a certain stimulation in the June returns, from both the treatment and development standpoints. The tonnage handled was 19,400 at a total cost per ton of 20s. 7½d., and the profit was £17,390, both figures being records. In the Motor mine ore averaging £6 per ton over 59 in. has been opened up in the south drive at the fifteenth level. A winze sunk 105 ft. from the eighth level in the Petrol section is in rich ore, the last 20 ft. giving £10 per ton over 37 in., with the reef not fully exposed.

Some time ago G. W. Campion, general manager of the Taquah and Abosso mines, paid a visit to the Rand with a view to investigating conditions there and ascertaining whether any practices were applicable to West Africa. He discovered that the use of jackhammers not only increased footage, but resulted in the lowering of costs on one large mine from 54s. per fathom to less than 39s. per fathom. On his return he experimented at the Abosso mine, and met with such success that he recommended the installation of a full equipment of jackhammers. The board agreed to this, and the installation should soon be complete. With the few machines already at work an improvement is shown, and it is hoped to overcome the effect of the labor shortage in this way. Chairman T. F. Dalglish, at yesterday's meeting of shareholders, said, "We now know sufficient to express confidence that the drills will enable us to increase the tonnage treated considerably."

The Abbontiakoon is another West African mine troubled with labor shortage. This appears to be the principal reason for reorganization.

Societies, Addresses, and Reports

A Federal Geological Survey for Australia

State Geologists at Melbourne Meeting Believe It Would Serve Useful Purpose—Think It Will Facilitate Search for Petroleum

AN AUSTRALIAN interstate conference of government geologists was held in Melbourne recently under the auspices of the Commonwealth Institute of Science and Industry. As a result of their deliberations it was decided to recommend that a federal geological survey be formed, and it was suggested that, with the concurrence of the states, this should deal with the structure and geological history of Australia. In regard to the mandated territories, it was recommended that the survey should deal with the structure and economic resources of the territories. In the discussion as to the best method by which the commonwealth could assist in or facilitate the discovery or production of mineral oil in Australia, it was pointed out by delegates that the proffered bonus of £50,000 to the discoverer of oil in commercial quantities was not the best way of spending the money. The experience of older countries with profitable oil fields had shown that the most efficient way of facilitating the discovery of new fields was by first making a systematic and detailed geological survey of likely territory. In this way the chances of discovering oil were increased sixty-fold. A resolution was finally adopted recommending that the federal government arrange for such surveys to be made of localities likely to contain oil, particularly Papua and the mandated territories of New Guinea. In connection with the bonus for the discovery of oil, it was pointed out that while this offer should be withdrawn, the bounty being paid on the production of shale oil should be continued. The conference also recommended that the geological surveys in the various states should be pushed as rapidly as possible, and that detailed maps should be made of any areas in which there was any likelihood of oil occurring.

Idaho Bureau of Mines Announces Program

The projects authorized for the current year by the Idaho Bureau of Mines and Geology, according to Francis A. Thomson, dean of the school and ex-officio secretary of the bureau, include geological work in co-operation with the U. S. Geological Survey as follows:

Completion of the reports on the Seven Devils copper deposits in Adams County, the work on which has been done by F. B. Laney; completion of the pending report on the Pend Oreille area in Bonners County, the work on which has been done by Edward T. Sampson and H. L. Gilson; completion of the report on the geology and resources of the Hailey area by Clyde P. Ross.

New projects in co-operation with the federal survey include a topographic and geologic survey of the Craters of the Moon area in Butte County. The topographic work on this area will be in charge of Max Gleissner. A survey of the geology and mineral resources of the Silver City and South Mountain areas in Owyhee County will be in charge of A. M. Piper, assisted by Martel Archibald, and will be under the general supervision of F. B. Laney. A survey of the thermal and mineral springs of the state will be begun this summer by Francis A. Thomson, as time and other duties permit.

In co-operation with the U. S. Bureau of Mines, of which A. W. Fahrenwald is the local representative, the study of classification begun by Mr. Fahrenwald during the past year will be continued. This study has been highly productive and the milling practice of the state has been improved through the installation of apparatus for classification devised by Mr. Fahrenwald as a part of his work. Studies will also be continued in the possible improvement of table concentration both in the laboratory at Moscow and in the larger milling plants throughout different parts of the state. Edwin Joyce, of the University of Idaho, Rollin Farmin, of Stanford University, and Thomas H. Miller, of the University of Wyoming, will be the holders of the Bureau of Mines graduate fellowships in the university during the year and will be engaged in a study of Idaho ore treatment problems under Mr. Fahrenwald's direction.

As non-co-operative or purely state projects, the following have been authorized and are either in progress or will soon be started: Completion of the survey of the geology and mineral resources of Boundary County. This survey, which is in charge of Virgil R. D. Kirkham, assisted by Ernest W. Ellis, was begun last year but carried over for lack of funds. A geological reconnaissance of western Clark and eastern Custer and Lemhi counties will be made by Mr. Kirkham after the completion of the Boundary County work. His assistant will be Norman White, of Wallace. The purpose of the reconnaissance is to establish whatever correlation may be possible between the sediments north and west of the Snake River lava flows with the sediments to the south and east thereof. A survey of the Rocky Bar quadrangle, including the old camps of Rocky Bar and Atlanta, is being carried out by S. M. Ballard, assisted by Joseph Skidmore. A state-wide survey of the road-building materials of the state is being made by Alfred L. Anderson, of the Idaho "Tech" faculty. This survey is being made jointly by the Idaho Bureau, the Public Works Department and the Highway Laboratory of the University of Idaho.

Air Transportation Survey to Be Made

Department of Commerce and American Engineering Council Will Undertake Project at Early Date

Owing to the increasing recognition of the importance of air travel to mining men engaged in exploration and development work in isolated regions, the announcement of the Department of Commerce that a world economic survey of air transportation will be undertaken by the department and American Engineering Council has aroused interest in various quarters. Secretary Hoover's name is mentioned in connection with the plans.

The department is said to have received many communications urging that the government interest itself in the problem and suggesting that, unless definite action be taken, the United States may be outstripped by other nations in this field.

There have been requests for a government bureau of commercial aviation, but this is not contemplated as an immediate development. The department has agreed to make available its facilities where this will not interfere with other work or call for additional appropriations. Various divisions of the Bureau of Standards will co-operate and agents of the department in foreign countries who are studying the progress of commercial aviation abroad will aid also.

Under the plan proposed, a committee of six, with J. Walter Drake, Assistant Secretary of Commerce, as chairman, will direct the work. A field staff is being organized with Prof. Joseph W. Roe, head of the department of industrial engineering in New York University and vice-chairman of the committee of six, as director.

The other members of the committee are: Dr. W. F. Durand, president of the American Society of Mechanical Engineers, New York; Prof. E. P. Warner, head of the aëronautical engineering course at the Massachusetts Institute of Technology; Luther K. Bell, of Washington, traffic manager of the U. S. Air Mail; C. T. Ludington, of Philadelphia, aircraft operator.

The field staff will include J. Parker Van Zandt of the U. S. Air Service, who has recently made an extensive study of civil aviation abroad, and Prof. Alexander Klemin, head of the aëronautical engineering course in New York University. Lieutenant Van Zandt is secretary of the committee. The staff has already begun its task, which, it is expected, will be completed in about six months.

"At the outset," said Professor Roe, "a comprehensive survey will be made of commercial air lines in other countries. This will be followed by a similar study of what has been done in the United States. There will also be a review of the government aid offered to water transportation. There will be a study of applications of aircraft to industrial uses other than transportation.

"There will also be a study of the geographic, economic, and operating conditions in the United States."

Men You Should Know About

James Douglas is stopping in Paris on his return from South Africa.

Henry Wyman has been elected a director of the Carnegie Lead & Zinc Co., Pittsburgh, Pa.

Fred Hellman, mining engineer, of New York, is visiting in California after an automobile trip to the West.

J. M. Callow has gone abroad. He will visit Spain, Belgium, France, and Norway on behalf of the General Engineering Co.

T. A. Rickard stopped in New York two days on his way back to San Francisco from London. He had been in South Africa for two months.

J. W. Sherwin, general manager for the West End Consolidated Mining Co. and affiliated companies, is in Tonopah, Nev., inspecting local operations.

R. P. Carr, mining engineer, formerly with the Braden Copper Co., is now manager of the Compania Restauradora del Chivato, at Talca, Chile.

Fred L. Cole, manager for the reorganized Montana Tonopah Mining Co., at Tonopah, Nev., has returned to Tonopah from a business trip to Salt Lake City.

R. C. Eisenhauer, who was until recently superintendent of the Carson Hill Gold Mines Co., is now a resident of Berkeley, Calif., and is engaged in professional work.

George I. Barnett, mining engineer with the West End Consolidated Mining Co., at Tonopah, Nev., has returned to Tonopah from a several weeks' trip to various Pacific Coast points.

George Kingdon, general manager of the United Verde Extension Mining Co., has returned to Jerome, Ariz., after a journey through the gold and copper mining regions of South Africa.

Roland B. Day announces that the petroleum and oil shale consulting practice of Dr. David T. Day will be continued under his direction at 715 19th St., N. W., Washington, D. C.

Stanley L. Arnot, who was for a number of years superintendent of the Plymouth Consolidated Gold Mines, Ltd., at Plymouth, Calif., has been spending a few weeks in San Francisco.

Dr. L. D. Ricketts, of Warren, Ariz., received the degree of doctor of engineering from Princeton University at the recent commencement. Honorary degrees were conferred on ten men, each eminent in his particular field.

Alexander Leggat, mining engineer, of Butte, Mont., is about to go to Yukon Territory to examine silver-lead properties on Tagish Lake, near the British Columbia boundary. He will return to Butte about the middle of August.

A. W. Stickney, mining geologist, of San Francisco, recently addressed the Engineers Club of San Francisco on "Personal Experiences in Bolshevik Russia." Mr. Stickney was formerly with the Russo-Asiatic Consolidated and was in Russia at the outbreak of the revolution.

H. H. Hill, who has been assistant chief petroleum technologist of the Bureau of Mines, has been made chief of that division to fill the vacancy caused by the resignation of F. B. Tough. Mr. Tough elected to stay with the leasing work, which was transferred to the Geological Survey.

Prof. N. I. Truschkoff has been elected professor of ore mining in the School of Mines, Leningrad, Russia. He

Prof. N. I. Truschkoff

is also engaged in preparing a book on ore mining for Russian mining engineers, foremen and students, his aim being to introduce American mining methods and practice in his country.

Ralph A. Watson, who has been chief engineer for the Tennessee Copper Co. for the last five years, has gone into business for himself at Anaconda, Mont. His associates are Della Brinton, E. T. Keeler, C. B. Kerns, and Leland Campbell. They will specialize in the design and construction of metallurgical and chemical plants.

G. A. Bole has been designated supervising ceramist of the Bureau of Mines. He will have technical supervision of all ceramic investigations carried on by the bureau, both at the Columbus station and at the other experiment or field stations. Mr. Bole will continue to act as superintendent of the Columbus station.

Otto Wartenweiler, now a member of the firm of Smith-Emery Co., of Los Angeles, has been commissioned by the United Eastern Mining & Milling Co. to construct a cyanide mill with power plant for the El Tigre property in Mexico. Mr. Wartenweiler has been consulting engineer to the United Eastern company since its organization.

T. F. Sutherland, chief inspector of mines for Ontario, is on his way to South Africa to make a comprehensive study of mining at depth with a view to making the necessary changes in the mining regulations of the province, now that deep mining is being extensively practiced. Mr. Sutherland will make a special study of those features of mining at depth which have a bearing on the health and safety of mine workers. His tour will occupy at least three months and his duties in the meantime will devolve upon **A. R. Webster,** assistant mining inspector.

W. Aghan, geologist, Australia, on behalf of the New Caledonia Mineral Exploration Pty., Ltd., left Melbourne, Australia, in May, for New Caledonia to investigate an occurrence at Noumea, where an oil seepage had been reported to have been discovered by a native and had given, on analysis, satisfactory results.

Prof. J. B. Cunningham, head of the department of metallurgy and ore dressing at the Michigan College of Mines, Houghton, has resigned to accept the chair of metallurgy at the University of Arizona, Tucson. He will remain in Houghton for the summer, leaving for Arizona in September. Professor Cunningham has been professor of metallurgy at Arizona for the past four months, on a leave of absence from the College of Mines. He has been a member of the Michigan institution's faculty for the past thirteen years. His successor has not yet been named.

Obituary

Michael E. Purcell, who for more than twenty years was superintendent of the Consolidated Mining & Smelting Co.'s Rossland mines, died at his home in Spokane, Wash., recently, aged 68.

Harry Elliott, lawyer and pioneer miner, prospector and Indian fighter in the Silver City, N. M., district, died recently at his home in Bellevue, Ark. Mr. Elliott practiced law in Kingston and Hillsboro, N. M., when those two towns were booming camps; later he went to Silver City and practiced law in the firm of Elliott & Elliott.

Harvey Jackson Case, an engineer connected with the Ray Consolidated Copper Co., died on July 13 in the Ray Hospital, as the result of an operation for appendicitis. Mr. Case was the eldest son of C. O. Case, state superintendent of schools for Arizona, and a graduate of the University of Arizona. As a diversion, Mr. Case wrote short stories, one dealing with mining and mine prospecting in the Southwest, entitled "The Quest of the E Pluribus," having appeared in the April number of *Adventure.* All offices in the state Capitol were closed for the funeral upon orders of Governor Hunt.

Harry Hermann, known as "Uncle Harry," pioneer lumber and mining man of the Southwest, died at the Ladies' Hospital in Silver City, N. M., the morning of July 7 after a very brief illness; he was within a few weeks of his eighty-second birthday. Mr. Hermann was a pioneer in Wyoming and Colorado, and went to New Mexico in 1882; he had been in the Mogollon district ever since that date. He was the largest property owner in Mogollon, and owned some valuable mining property in that vicinity. His body was taken to Mogollon to lie at the side of his wife, who was buried there many years ago.

Recent Technical Publications

Reviews, Abstracts, and References

An English Book on Cadmium

Cadmium: Its Metallurgy, Properties, and Uses. By Norman F. Budgen. Published by Charles Griffin & Co., Ltd., London. J. B. Lippincott Co., Philadelphia, Pa. Price $8.

No separate book on the subject of cadmium had appeared until this was published, though both Ingalls and Hofman devoted a portion of their books on zinc to the rarer metal. The volume under review is no doubt the most complete treatise on cadmium that has so far been written. Most of it is a compilation of previously published material, though the sources of information are given and the author's indebtedness to others is freely acknowledged. American metallurgists who have had cadmium-bearing material to treat or refine will not find a great deal that is new in this book, but they will find more about foreign practice than would be expected in an American book; they will smile at the full-page photograph facing page 31, which, according to the caption, is a view of the "bag house at Herculaneum, Montana." After all, it is more sensible perhaps that "Mo." should be the abbreviation for Montana rather than Missouri.

Perhaps the most helpful portion of this book is the last part, dealing with the alloys and uses of the metal. Though a comparatively high-priced metal (it sells at 60c. per pound), several new applications of cadmium and its compounds have found commercial application in recent years and as the properties become better known others will no doubt be found.

Mississippi Valley—The Missouri Bureau of Geology and Mines, Rolla, Mo., has recently issued a book of 86 pages covering a "Structural Reconnaissance of the Mississippi Valley Area From Old Monroe, Mo., to Nauvoo, Ill." The work was done in co-operation with the Illinois Geological Survey.

Alaska—U. S. Geological Survey Bulletin 772, 32 pp., is "A Reconnaissance of the Point Barrow Region, Alaska," by Sidney Paige, W. T. Foran, and James Gilluly. This investigation was carried on to get further information regarding the presence of oil and coal in this region, in the extreme northern part of Alaska. The indications for oil were found to be favorable and good deposits of coal are in evidence, though much further work must be done. The district is one of the U. S. Navy's petroleum reserves.

Aniakchak Crater, Alaska—A gigantic crater northwest of Aniakchak Bay, in the Alaskan peninsula, was discovered in August, 1922, and is described in Professional Paper 132-J, obtainable on request from the U. S. Geological Survey, Washington, D. C. It is said that this is one of the great natural curiosities of North America, and the nearest counterpart on earth to the craters of the moon, in regard to the manner of its formation.

Lead-Zinc Ore Concentration—"Concentration of Lead-Zinc Ores of Eastern Canada," by C. S. Parsons, 12 pages, appears in the *Bulletin* of the Canadian Institute of Mining and Metallurgy for July (Drummond Bldg., Montreal; price $1). Mr. Parsons describes the test work carried on by the Mines Branch at Ottawa.

Prospecting — In the bulletin just mentioned also appears a 24-page article by K. W. Fritzscheon, "Prospecting in the Quebec Gold Belt." This will be of interest to all prospectors, as lists of supplies needed are given, with much other information and advice of general application. Anyone who contemplates prospecting in Canada will find this article decidedly worth reading.

New South Wales—The annual report of the New South Wales Department of Mines, for 1924, has been issued and is obtainable from the department, at Sydney, for 5s. 9d. The total value of the mineral products was £18,623,088, the greatest in history. Several bulletins on various metals and non-metallic minerals have also been issued recently by the New South Wales Geological Survey. These include: Bulletin No. 6, "The Coal Resources of New South Wales," 154 pages, 2s. 9d.; No. 9, "Limestone, Dolomite, Lime, and Hydraulic Cement," by Leo J. Jones, 37 pages, 2s. 8d.; No. 13, "Chromium, Cobalt, Nickel, Zirconium, Titanium, Thorium, Cerium," by H. G. Raggatt, 17 pages, 1s. 1d.; No. 14, "Asbestos, Emery, Fluorspar, Fuller's Earth, Graphite, Phosphates, Talc, and Soapstone," by H. G. Raggatt, 31 pages, 1s. 1d.; No. 15, "Diatomite, Siliceous Earths and Sands," by E. J. Kenny, 18 pages, 1s. 1d.; No. 16, "Barytes, Ochres, and Oxides," by H. G. Raggatt, 16 pages, 1s. 1d.; and Mineral Resources Bulletin No. 33, "The Gypsum Deposits of New South Wales," by Leo J. Jones, 45 pages, 2s. 8d.

Missouri Mining — The biennial report of the State Geologist is now available from the Bureau of Mines and Geology, Rolla, Mo., obtainable on request. An extensive chapter is devoted to the mineral production of the state, with the names and addresses of all producers. The principal products are lead ore, coal, clay products, cement, limestone, sand and gravel, lime, clay, marble, and barytes. The last part of the bulletin is devoted to stream flow records.

Treatment of Platinum Ores—Bernard W. Holman has a short article on this subject in *The Mining Magazine* for May (London; price 1s.), mentioning briefly the various methods of extracting platinum from its ores.

Power Station Operation—A recent practical handbook of 100 pages of questions and answers for the power station operator has been issued in England. It may be obtained from Electrical Times, Ltd., London, W. C. 2, for 3s. 10d. This book, based on English practice, should contain much information of value to the American operator.

Philippine Islands—The "Geology and Mineral Resources of the Philippine Islands" are discussed at length in an illustrated book of more than 600 pages, by Warren D. Smith, designated as Publication No. 19 of the Bureau of Science, Manila. This is a summary of what is known of Philippine geology and mining, including specialized regional geology, seismology, volcanology, and mineralogy. An appendix contains data on the laws and regulations. Economic geology receives particular attention. Copies are obtainable on request from the bureau at Manila, or possibly the author, who is now at Eugene, Ore., can supply a few.

Leaching—A. W. Allen has a 5-page article in *Chemical and Metallurgical Engineering* for June (New York; price 35c.) on "Technology of Leaching and Extraction." This is a discussion of the scope of bulk leaching and the fundamental principles involved.

Magnesium—Also, in the magazine just mentioned, is a reprint of William G. Harvey's paper read at the American Electrochemical Society's meeting, on the "Production of Metallic Magnesium From Fused Salts." The electrolytic chloride and oxide processes are described.

Zinc Mining—*Compressed Air Magazine* for July (New York; price 35c.) has an illustrated 8-page article by Robert G. Skerrett on "The Wonder Camp That 'Jack' Built," describing in general terms the practice in the Picher zinc field of northeastern Oklahoma.

Zinc Metallurgy — Technical Paper 341 of the U. S. Bureau of Mines, Washington, D. C., 25 pages, obtainable for 5c. from the Superintendent of Documents, Washington, D. C., is a discussion by B. M. O'Harra on the "Metallurgical Treatment of Zinc-Retort Residues." These smelter residues, a large accumulation of which exists at the smelters, contain from 5 to 15 per cent zinc, unburned coal, and in some instances lead and silver. Many methods of treatment are outlined, some of which have received commercial application; they include smelting, screening, magnetic separation, wet concentration, and burning on Wetherill grates for the production of zinc oxide.

U. S.-Canada Boundary—The third report of the International Boundary Commission engaged on a survey and demarcation of the boundary between the United States and Canada has recently been issued as an elaborate bound book of 512 pages. This section of the report covers that part of the boundary from the source of the St. Croix River to the St. Lawrence River. Obtainable from the International Boundary Commissioners, Washington.

North Dakota Lignite—"The Lignite Deposits of North Dakota" are discussed by Arthur G. Leonard, Earle J. Babcock, and Leonard P. Dove in Bulletin No. 4 of the North Dakota Geological Survey, Grand Forks, N. D., 240 pages, obtainable on request.

Index of Water Analyses—The U. S. Geological Survey, Washington, D. C., has issued, for free distribution, Water-Supply Paper 560-C, by W. D. Collins and C. S. Howard, an "Index of Analyses of Natural Waters in the United States."

New Machinery and Inventions

Newly Designed Speed Reducer Has Interesting Features

A speed reducer so designed that it reduces the starting torque one-third and eliminates all vibration and back lash, making the gear practically noiseless, has been introduced recently by W. C. Lipe, Inc., 208 South Geddes St., Syracuse, N. Y. This reducer, which is made under the Tyler patents, is of full planetary construction, having two or three planets (depending on the service) mounted in a cage that is supported on both ends on ball bearings. The studs on which the planetary gears rotate are supported on both ends in this cage, the planetary gears being bronze bushed.

The low-speed shaft is connected to the cage by means of a flexible connection, which is mounted in the end flange of the planetary gear cage as follows: In the flange of the cage is an annular flange or ring, inside of which are circumferentially mounted a number of rockers, having a tooth that projects inward to engage with a toothed sector or spider, which is keyed and shrunk on the low-speed shaft; these rockers and the low-speed shaft are supported on both ends, which eliminates any possibility of deflection and gives a perfectly balanced cage.

In the annular flange or ring are mounted spring plungers with the plungers extending inward and engaging on each end of the rocker (there being one on either side). In operation, as power is applied to rotate the high-speed pinion, the cage starts to revolve, the low-speed shaft remains fixed until the rotation of the cage causes the teeth of the toothed sector, which is fixed to the shaft, to engage with the teeth of the rockers, thereby rocking the rocker and compressing the spring plunger on either side of the rocker (depending on the direction of rotation) until the rocker bottoms on the inside of the annular flange, when the low-speed shaft picks up the load. The bottoming of the rocker gives a positive contact and does not operate on the springs.

The functioning of the spring plungers gives very positive advantages. In the first place, while the springs in the plungers are being compressed, the only load the motor has to assume is sufficient power to compress seven, eight or more springs (depending on horsepower and size of gear). This means that while the springs are compressing, the rotor of the prime mover has a chance to start with practically no load and picks up the load gradually, while the planetary gears make a quarter turn, thereby giving the gears and prime mover a start before picking up the load, and reducing the starting torque 33⅓ per cent.

Also, while the springs are being compressed, the teeth of the gears are held in tight contact, thereby eliminating all vibration and back lash, thus making the gear noiseless.

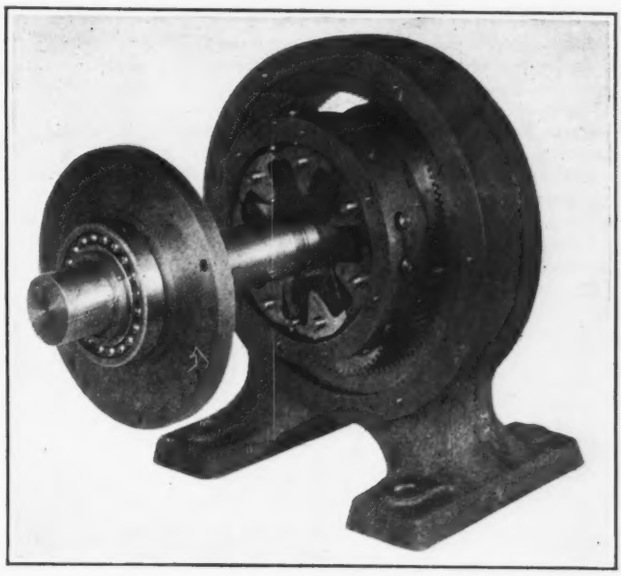
The high-speed and low-speed shafts are concentric with each other in perfect axial alignment. The pinion on the high-speed shaft floats and equalizes the load between the planetary gears, eliminating all side strains, and gives a perfect torque and an evenly divided load with all tooth pressure evenly balanced; also eliminating the tendency to deflect the shafts and produce unequal stress on the bearings, so that the bearings have only the weight of the rotating members to support.

The rotating members are totally inclosed, are dust-proof and fool-proof. Up to and including 1,800 r.p.m. the rotating parts run in oil, and above 1,800 r.p.m. a forced feed lubrication is used.

The maintenance cost is said to be negligible, the only requirement being to see that there is plenty of oil in the casing.

The gear operates in either direction. It is used to step up as well as down. It can be had in any ratio from 4:1 to 25:1 in single reductions and up to 200:1 in double and triple reductions and in any horsepower up to and including 500 hp.

Speed reducer with low-speed end housing removed, showing flexible connection



Heavy Gasoline Locomotive for Switching Service

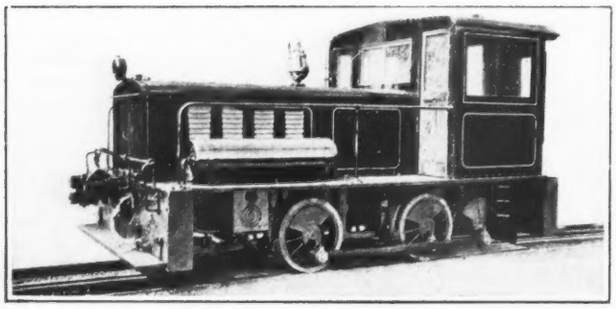
For purposes where heavier gasoline locomotives are required the Vulcan Iron Works, Wilkes-Barre, Pa., has recently developed a new twenty-ton machine, to be known as its Model HS-20. The company has designed this locomotive along much the same lines as its other heavy models. Steam locomotive practice is followed very closely in the chassis construction, the frames being of open-hearth cast steel (open-bar type), which affords long life and accessibility to all underneath parts. Springs are of the elliptic type with cross-equallizing arrangement, giving three-point suspension. On standard-gage track, in shifting railroad cars, for which work this machine is primarily adapted, the locomotive is furnished with M.C.B. automatic couplers with spring buffer and draft rigging arrangement in the bumpers. This device takes up the shocks encountered in coupling and relieves the strains in pulling and pushing the heavy railroad cars, thereby protecting the motor and other working parts of the locomotive. The locomotive is mounted on four steel-tired driving wheels.

The locomotive is powered with a six-cylinder, 125-hp. motor. The motor is of a heavy-duty industrial type with crank shafts of drop-forged chrome-nickel steel, heat-treated and accurately machined as well as counterbalanced, thus permitting the engine to run at a moderately high speed without undue vibration.

A built-in governor is provided, gear driven and well lubricated to guard the engine against overspeeding and racing. There is a centrifugal water pump of ample size to provide proper cooling. There is also a forced feed lubricating system to the main connecting rod and cam shaft bearings. All the oil that is not consumed is drained back to a pump, where it is strained and recirculated. Proper oil pressure is maintained by a spring loaded pressure relief valve.

A dual ignition system from a high-tension magneto with impulse coupling and a battery distributor with coil is used. Spark control of the two instruments is synchronized by a unique linkage mounted on the side of the magneto bracket and connected by a rod to spark control lever. Two spark plugs per cylinder are used, the magneto being connected to the spark plug over the intake valve and the battery distributor to the spark plug over the exhaust valve.

The motor is equipped with modern accessories, such as electric starter and generator, Stromberg carburetor, and storage battery. The engine is provided with an oversized multiple disk



This 20-ton gasoline locomotive has maximum drawbar pull of 12,000 lb.

clutch running in a bath of oil, permitting easy starting of the load with very light pressure on the foot pedal.

The transmission is a perfected trouble-proof transmission that insures efficiency by completely elminating gear clashing and the difficulties that grow out of gear shifting. By using constant mesh gears instead of the sliding type, speed changes are made more quickly and easily without loss of acceleration to the locomotive. The speed changes are made by the engagement of indestructible jaw clutches. Gears, clutches, and shafts are chrome-nickel alloy-steel forgings properly heat-treated and hardened, thereby insuring long life and no replacements.

The final drive is by means of driving and parallel rods from cranks on the jack shaft to the crank pins in the driving wheels, traction being thus provided on all wheels.

The air equipment is of the straight air and automatic brake type, complete with air compressor, distributor valve, reservoirs, and all accessories. The air compressor is driven from a power take-off on the transmission and is provided with an automatic governor throwing the air compressor out of engagement when the pressure in the reservoir reaches a predetermined point.

The locomotive is designed for four speeds forward and four speeds reverse, geared from two to fifteen miles per hour, with a maximum drawbar pull of 12,000 lb. It has a comparatively short wheelbase and can negotiate reasonably sharp curves.

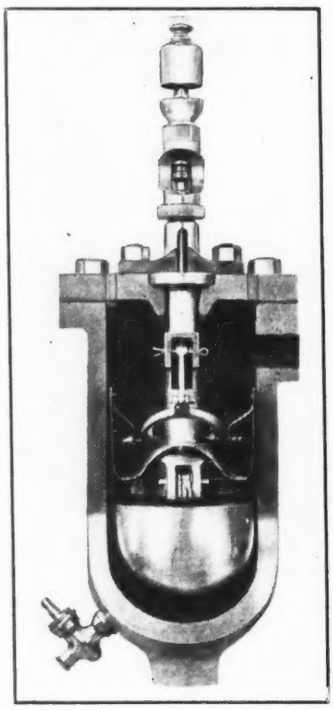
Water Alarm Fits Externally to the Boiler

A new water alarm recently developed in England is fitted externally to the boiler. It consists of a float chamber, the cover of which carries the working parts. By raising this cover, the complete mechanism can be lifted out for repairs or inspection, without disconnecting the steam or water connections, and this is a decided advantage over internal alarms that are quite inaccessible.

The working mechanism consists of a central spindle, to which are attached two open buckets, the upper bucket resting on parts called toggles, the latter gripping a collar on the spindle. The spindle is connected to the upper spindle by toggle links, the upper spindle carrying the bucket and slides in the valve, which operates the steam whistle. In operation both buckets are filled with water.

At normal level, both buckets are full of water and the second bucket is completely immersed in water; the other bucket, being full of water, is heavier, the second bucket is depressed and the toggle gear is lifted so as to close the valve and the whistle cannot operate.

At low level, both buckets are not immersed in water, but both are full of water. In this case, the second bucket is the heavier and in sinking pulls the spindle down, opens the valve and the whistle sounds. At high level, the



Cross-section of high and low water alarm for external fitting to a boiler

second bucket is heavier and pulls the spindle down so the warning whistle blows.

This water alarm is manufactured by Ronald Trist & Co., Ltd., 12 Clipstone St., London, England.

Coal Handling

The Link-Belt Co., of Chicago, has issued a new 68-page book describing new methods for handling coal and ashes in boiler houses. The book contains many data of interest to engineers and architects and is of particular value to anyone interested in boiler houses and their equipment. The Peck carrier, which is described, is also used for handling cement, sand, ore, and other materials. A copy will be mailed upon request to the Link-Belt Co., Chicago, Indianapolis, or Philadelphia.

Trade Catalogs

Pumps. Layne vertical centrifugal pumps, for wells 8 in. or more in diameter and 50 to 600 ft. deep. Circular, 4 pp. Layne & Bowler Co., Memphis, Tenn.

Pumps. "The Automatic Operation of Centrifugal Pumps" is the title of a new 24-p. bulletin issued by Barrett, Haentjens & Co., Hazleton, Pa. It describes methods used to make centrifugal pumps start, stop and run without constant attention and shows how various automatic control devices can be used to insure protection against damage due to loss of water, suction air leaks and other operating difficulties. Copies will be furnished on request.

Rock Drills. Model 39 of the Waugh Turbo stoper is described in Bulletin 100 A, 12 pages, just issued by the Denver Rock Drill Manufacturing Co., Denver, Colo. This is the stoper used in the upper enlargement of the Moffat tunnel. Its good points, according to the manufacturer, are: Turbine-driven rotation is mechanically correct; fatigue on the operator is greatly reduced; steel troubles are practically eliminated; lineal footage per drill shift is materially increased; and the water jet protects the health of the miner.

Mine Locomotives. Trolley-type gathering locomotives for mine works are described in Bulletin GEA-70, issued by the General Electric Co., Schenectady, N. Y.

Welding Safety Points. "Precautions and Safe Practices" is the title of a 16-page book describing safe practices in welding and cutting, which has been received from the Oxweld Acetylene Co., New York.

Conveyor Scales. A catalog of the Stearns Conveyor Co., Cleveland, Ohio, covers the Messiter conveyor scale, the latest addition to the company's line of material-handling equipment.

Stokers. Detroit Underfeed stokers of the single retort type are described in a new 32-page bulletin (No. 1018) just off the press. It contains a number of fuel bed cross-sections showing conditions of the fire with respect to air distribution and movement toward the dumps. Another section is devoted to the application of the stoker to both low and high set boilers. Another shows how twin settings serve very large boilers. Copies may be had from the Detroit Stoker Co., General Motors Building, Detroit, Mich.

Locomotives, Gasoline. Vulcan Iron Works, Wilkes-Barre, Pa., builder of locomotives, has issued an 8-p. bulletin, No. 102, featuring its 16- and 20-ton gear-driven gasoline locomotives. Complete specifications and general description of these two sizes are included, as well as hauling capacity charts.

Grinder. Bulletin 1,306 of the Hisey-Wolf Machine Co., Cincinnati, Ohio, announces a new 5-hp. electric production grinder.

The Market Report

Daily Prices of Metals

July	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
16	14.125	56.75	57.875	8.00	8.00	7.175@7.20
17	14.125	57.25	58.375	8.00	8.00	7.20
18	14.125	57.50	58.625	8.00	8.00	7.20@7.225
20	14.125	57.50	58.50	8.15	8.00	7.25
21	14.125	57.50	58.625	8.20	8.10	7.25@7.30
22	14.125	57.75	58.875	8.20	8.10	7.325@7.35
Av.	14.125	57.375	58.479	8.092	8.033	7.244

*The prices correspond to the following quotation for copper delivered: 14.375c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
16	61 3/4	62 3/4	66 1/4	258 1/2	260 3/4	34 5/16	33 11/16	34 3/4	34 1/4
17	61 7/8	62 7/8	66 1/2	260 3/4	263 1/4	34 1/2	33 15/16	34 7/8	34 1/2
20	62	63	66 3/4	261 1/4	263 3/4	34 3/8	34 3/16	34 15/16	34 5/8
21	62 1/8	63 1/8	67	261 3/8	263 7/8	35 1/8	34 5/8	35 5/16	34 15/16
22	62 1/4	63 1/4	67	262 3/4	265 3/8	35 3/8	34 3/4	35 11/16	35 1/4

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	July	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
16	4.85 5/8	69 5/8	32 1/16	84s 11 1/2d	20	4.85 5/8	69 1/2	32	84s 11 1/2d
17	4.85 5/8	69 3/8	32	84s 11 1/2d	21	4.85 5/8	69 3/8	32 1/8	84s 10 1/2d
18	4.85 5/8	69 3/8	32	....	22	4.85 5/8	69 1/4	32 1/16	84s 10 1/2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Metal Markets Quieter, but Prices Advance

New York, July 22, 1925—Prices of copper, lead, zinc, and tin are all higher than a week ago, though the demand has materially diminished. Most producers are well sold up and believe that fundamental conditions are so good that higher price levels are to be expected.

Copper at 14 3/8c. Delivered

Practically all the copper sold to the usual delivery points in the East since last Wednesday has been booked at 14⅜c., though the price today is a much firmer 14⅜c. than it was last Thursday. At that time, some metal was offered at 14.275c. delivered in Connecticut, and as late as Friday some spot metal was actually sold as low as 14¼c. However, sales to New York, Pennsylvania, and Michigan points were in fair volume at 14½c. or slightly below, so that producers netted well over 14c. f.o.b. refinery. In the last day or two some sellers have practically withdrawn from the market owing to their recent heavy business, and have been quoting 14½c. delivered Connecticut. No sales have so far been reported at that level, however, as several producers are still willing to book orders at the 14⅜c. level. The total volume of business for the week ending today has been slightly less than half that of each of the two weeks immediately preceding. Most of the inquiry has been for August or September. An occasional lot of spot copper has been sold at slight concessions, but there is little demand for early delivery, and also but little available.

The export market has been quiet all week, though it has improved slightly the last two days. Prices abroad have advanced almost daily, 14.60@14.65c., c.i.f. having been done on the Continent the last two days.

Smelting Company Advances Lead

The contract price for New York lead set by the American Smelting & Refining Co. was advanced from 8 to 8.10c. on Monday, July 20, and to 8.20c. on Tuesday, July 21. The two advances came as a surprise to the trade, as by Monday the premium prices that had been quoted in the outside market the week before had become only nominal, and the demand had quieted down very decidedly. The advance seems to have been inspired by increased confidence in fundamental conditions, and to a feeling that the New York price should exhibit a reasonable differential above that at St. Louis. It has also been suggested that a slight advance might stimulate trade in a quiet market. On Monday, a small amount of business was done in the East at premiums over the Smelting company's price, but in the last two days but little interest has been taken in the market despite the fact that offerings at the 8.20c. level are none too free.

In the Middle West, the principal producer has continued his efforts to hold the market in check at the 8c., St. Louis, level, and has sold a fair tonnage. Other sellers have maintained their prices generally above that figure, particularly since the advance in the East, and yesterday several carloads were sold as high as 8.30c., St. Louis, though neither of the principal producers are quoting so high as that. Today the market seems to be 8@8.10c., St. Louis, to approved consumers, with dealers compelled to pay in the neighborhood of 8.30c. Chicago prices have ruled about 10 points above St. Louis. Corroding lead has sold at premiums of $2 to $3 per ton above common lead, as is usual, the $2 premium being ordinarily quoted.

Daily Advances in London Zinc

The domestic demand for zinc has fallen considerably below that of last week, but the London market has been strong, registering daily advances, so that today the export price is again up to domestic parity and zinc has been sold for export on a basis of 7.35c., St. Louis. Three or four good-sized parcels have been sold in the last three

days, since the market has shown such decided strength, but the usual run of small orders has not been in evidence. Brass mills have bought moderately at premiums of 10 points for Brass Special grade. No pressure is being put on the market by producers, and any small lots that are offered are quickly absorbed by the large dealers; in fact, dealer buying has been more in evidence than for some time, a continued rise in price evidently being expected by this group. Today the market is firm at 7.325c. or slightly above. High-grade zinc continues unchanged at 8.50@8.75c., delivered.

Tin Generally Quiet

Monday was a rather active day in the tin market, with good buying by consumers, but the week as a whole has been a quiet one, with practically nothing doing on Saturday, as is usual for that day in midsummer. The London price has advanced daily, which has resulted in correspondingly higher levels here, until 58⅞c. was reached here for spot tin today. Forward tin has ruled from ⅛ to ¼c. less.

Silver Quiet and Steady

Silver, both here and abroad, has been quiet but very steady, China's varying position being responsible for the slight fluctuations in the London quotation. Indian bazaars again showed moderate interest, but their rates are still considerably below current prices in this market. New York closed steady at a premium above London.

Mexican Dollars: July 16th, 53⅜c.; 17th and 18th, 53⅝c.; 20th, 53½c.; 21st and 22nd, 53⅝c.

Exchanges Slightly Higher

The foreign exchange market has been quiet with slight gains for francs and lire. Closing cable quotations on Tuesday, July 21, were: francs, 4.73c.; lire, 3.705c.; and marks, 23.805c. Canadian dollars, 1/32 per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c per lb.; 98 per cent, 27c. London, £118 per long ton for 98 per cent.

Antimony—

Chinese brands, July, 16@16¼c. per lb.; August, 16c.

Cookson's "C" grade, spot, 19⅝c.

Needle and oxide nominally unchanged from quotations in July 4 issue.

Bismuth—$2.65@$2.70 per lb., in ton lots. London, 10s.

Cadmium—60c. per lb. London, 2s.3d.

Iridium—$400 per oz. for 98@99 per cent. Nominal. London, £80.

Nickel—Ingot, 34c.; shot, 35c.; electrolytic, 38c.; London, £170@£175 per long ton.

Palladium—$75@$83 per oz. Crude, $65. London, £16.

Platinum—$120 per oz. refined officially quoted. Sales also at $115@$118. Crude, $113@$114. London, £25 per oz. for refined; crude £23.

Quicksilver—$82.50@$83 per 75-lb. flask. San Francisco wires $82.67. London, £14¼.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten and **Zirconium** are unchanged from the July 4 issue.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports:

Brazilian, 42@44c.
Indian, 44c.
Caucasian (unwashed), 42c.
Caucasian (washed), 44c.

Tungsten Ore—Per unit of WO_3, N. Y.:

High-grade wolframite, $12. Ordinary quality, $11.50@$11.75. Scarce.

High-grade Western scheelite, $12.

Chrome, Galena and **Pyrite Radio Crystals, Iron Ore, Molybdenum, Tantalum,** and **Vanadium Ores** are unchanged from quotations in the July 4 issue.

Zinc and Lead Prices Unchanged

Joplin, Mo., July 18, 1925

Zinc Blende

	Per Ton
High	$55.20
Premium, basis 60 per cent zinc	$52.00@$53.00
Prime Western, 60 per cent zinc	$50.00
Fines and slimes, 60 per cent zinc	$49.00@$45.00
Average settling price, all	$49.27

Lead Ore

High	$106.83
Basis 80 per cent lead	$100.00
Average settling price, all	$102.57

Shipments for the week: Blende, 10,863; lead, 2,007 tons. Value, all ores the week, $741,160.

Shipment of a quantity of low-grade lead lowered the average price slightly more than would otherwise appear.

Buyers are offering no more than $50 basis for Prime Western zinc ore at 5 o'clock this afternoon, and are obtaining some ore, all, they claim, they want. A number of sellers are declining to accept this offering.

Report was published today of the sale by the Commerce Co. of 2,000 tons of zinc ore to the Associated Metals & Minerals Co., a subsidiary of B. Lissaur & Co., of Germany. Loading began this week and cars are on the track for the total tonnage.

Platteville, Wis., July 18, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$51.00
Lead Ore	
Lead, basis 80 per cent lead	$100.00

Shipments for the week: Blende, 870 tons; lead, none. Shipments for the year: Blende, 25,203; lead, 1,008 tons. Shipment for the week to separating plants: 1,440 tons blende.

Non-Metallic Minerals

Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the July 4 issue.

Feldspar—First quality, New Hampshire, $8.50 per ton. See also July 4 issue.

Mica—In North Carolina, No. 2 quality, stained, per lb.:

2 x 2 in., 25c.	3 x 4 in., $1.40
2 x 3 in., 55c.	3 x 5 in., $1.75
3 x 3 in., 90c.	4 x 6 in., $2.25

Punch, 5@7c.
Scrap, $30 per ton.
Market improving. Other prices in July 4 issue.

Mineral Products

Arsenious Oxide (White arsenic)—4¼c. per lb. Occasional carload sales.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and **Zinc Oxide** are unchanged from prices in the July 4 issue.

Ferro-Alloys

Ferrotungsten — $1.10 per lb., contained W.

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferro-uranium and **Ferrovanadium** are unchanged from the prices in the July 4 issue.

Metal Products

Rolled Copper—Sheets, 22¼c.; wire, 16c. per lb.

Nickel Silver—28⅜c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Sheets, 19⅝c. per lb.; rods, 16⅝c.

Lead Sheets and **Zinc Sheets** unchanged from July 4 issue.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and **Zirkite** are unchanged from prices in the July 4 issue.

Finished Steel Prices Lower

Pittsburgh, July 21, 1925

After four weeks of no reportable declines in prices of important finished steel lines, making the best record since the decline began in February, plates are now off about $1 a ton and shapes about $2 a ton. Thus they find a safer level, however, being at approximately last year's low point. The sheet market is gradually stiffening and is no longer a disturbing factor in the general steel trade. Bars remain quotable at 2c. as the general market, but are not very firm.

Pig Iron—Market quietness continues and seems unlikely to be broken in the near future. Prices are moderately firm, unchanged at $19 for bessemer, $18 for basic and $18.50 for foundry, at Valley furnaces.

Connellsville Coke—The fairly large accumulation of furnace coke on track of two months ago has been worked off. The market is dull and altogether steady at $2.75@$2.85 for spot furnace and $3.75@$4.25 for standard spot foundry, with no interest in contracts.

Company Reports

Winona Copper Co.

Copper; Michigan

Report of the Winona Copper Co., dated June 30, 1925, says that no work of any kind has been done at the mine since the issue of the last annual report. The directors express the belief that the showing here warrants, at a favorable time, a reorganization of the corporation, and, if possible, a merger with neighboring companies, in an effort to put Winona's costly mine and mill equipment to profitable use. Following is the treasurer's statement:

Assets

Cash	$172.74	
Accounts receivable	2,217.12	
Copper on hand	2,455.46	$4,845.32
King Philip purchase	$1,215,884.36	
Construction	560,989.83	
Mining property	450,000.00	
Stamp mill	426,198.85	
Real estate	18,581.33	
Mining property, shaft, etc	10,945.68	
Railroad	11,742.67	2,694,342.72
Unexpired insurance		63.95
		$2,699,251.99

Liabilities

Accounts payable	$429.19	
Advance on copper sales	3,050.00	
Accrued taxes	6,592.25	$10,071.44
Reserve for depreciation	$67,717.00	
Reserve for depletion	45,719.38	113,436.38
Delinquent stock sales		2,367.71
Capital stock	$4,166,675.00	
Less treasury stock	262.50	4,166,412.50
Profit and loss (surplus deficit)		1,593,036.04
		$2,699,251.99

Mond Nickel Co., Ltd.

Nickel, Copper; Ontario

Report of the Mond Nickel Co., Ltd., draws special attention to the resolutions to be submitted to the shareholders to increase the authorized capital of the company by the creation of 1,500,000 7 per cent cumulative "A" preference shares. The directors propose to issue 1,250,000 of these shares, and to make an issue of a new 5½ per cent debenture stock to the amount of £1,000,000. The proceeds of these issues will be applied to redeem the whole of the outstanding £1,300,000 8 per cent mortgage debenture stock, to repay loans, and to provide for extensions and further working capital. This would increase the total capital of the company to £4,900,000.

Profit and Loss Account for the Year Ended April 30, 1925

Expense

	£	s.	d.
To debenture interest	122,750	0	0
To general charges, including directors' and office salaries, and audit fee	51,954	12	9
To reserve for corporation profits tax	2,500	0	0
To balance, carried to balance sheet	313,039	3	9
	£490,243	16	6

Income

	£	s.	d.
By gross profit, including interest and dividends received	483,555	3	5
By transfer fees	329	12	0
By rents	6,359	1	1
	£490,243	16	6

Balance Sheet, April 30, 1925

Capital and Liabilities

	£	s.	d.	£	s.	d.
Capital						
Authorized and issued:						
500,000 7 per cent cumulative preference shares of £1 each, fully paid	500,000	0	0			
2,000,000 7 per cent non-cumulative preference shares of £1 each, fully paid	2,000,000	0	0			
900,000 ordinary shares of £1 each, fully paid	900,000	0	0			
				3,400,000	0	0
£375,000 5 per cent first mortgage debenture stock:						
Fully paid	375,000	0	0			
Interest accrued	9,375	0	0			
				384,375	0	0
£1,300,000 8 per cent mortgage debenture stock:						
Fully paid	1,300,000	0	0			
Interest accrued	52,000	0	0			
				1,352,000	0	0
Loan from bankers				126,000	0	0
Bills payable				381,787	13	10
Sundry creditors and credit balances				455,082	19	7
Unclaimed dividends and debenture interest				1,942	17	6
Reserve	345,000	0	0			
Less transferred to special depreciation reserve	185,000	0	0			
				160,000	0	0
Special depreciation reserve	116,000	0	0			
Add transferred from reserve	185,000	0	0			
	301,000	0	0			
Less written off mines and plant in Canada and United Knigdom, and shares and debentures	301,000	0	0			
Profit and loss account:						
Balance brought forward	40,403	3	0			
Balance at credit for year ended April 30, 1925	313,039	3	9			
	353,442	6	9			
Less directors' fees, 1924-25	15,651	19	2			
	337,790	7	7			
Deduct interim dividends paid March 3, 1925	132,500	0	0			
				205,290	7	7
				£6,466,478	18	6

Assets

	£	s.	d.	£	s.	d.
Mines, freehold and leasehold land, houses and smelting works in Ontario (Can.)	1,625,855	16	0			
Additions during the year, less written off special depreciation reserve	36,092	17	8			
				1,661,948	13	8
Land and freehold and leasehold property and refining works, United Kingdom	1,215,281	19	9			
Additions during the year, less written off special depreciation reserve	149,868	4	10			
				1,365,150	4	7
Shares, debentures and balance of associated company accounts and other shares and securities, less written off special depreciation reserve				1,106,582	5	0
Stocks on hand:						
Stores, tools, etc	238,207	15	9			
Ore, raw materials, intermediate and finished products	1,668,745	17	2			
				1,906,953	12	11
Sundry debtors and debit balances				404,125	16	9
Cash in hand and at banks				21,718	5	7
				£6,466,478	18	6

Mount Morgan Gold Mining Co., Ltd.

Gold, Copper; Queensland

Report of the Mount Morgan Gold Mining Co., Ltd., for the year ended May 31 last states: Revenue resultant on operations at mine, £595,847 0s. 6d. Expenditure charged, including development and £28,974 written off for depreciation, £753,274 16s. 7d., showing a loss on mining, treatment and realization of £157,427 16s. 1d., less interest on investments, less income tax, £86,823 1s. 7d., leaving a net loss for year £70,604 14s. 6d., less refund of Queensland income tax £4,240 17s. 2d., leaving £66,363 17s. 4d. Balance forward, £35,572 3s. 5d. Included in the total revenue from all sources is the valuation of 1,387 tons of copper on hand at the close of the year, which, as usual, has been taken at £55 per ton. As copper on hand at the close of the previous year amounted to 2,018 tons, the year under review has received credit for additional value over £55 per ton for excess tonnage, but notwithstanding this the above heavy loss is recorded, a large portion of which was due to the unfortunate movement which occurred underground in November last. Early in the calendar year the assistant general manager, J. Horsburgh, was sent to America to investigate the latest and most economical methods of treatment of low-grade copper ores, devoting special attention to the question of reverberatory smelting. Mr. Horsburgh has just returned to Australia, and at an early date his report and recommendations will be fully considered by the directors. During the period 208,557 tons of ore was raised. Production was 4,390 tons copper and 63,306 oz. gold, compared with previous year's production 4,729 tons of copper and 73,164 oz. gold. Improved recoveries referred to in last year's report as obtaining in concentrating mill have been well maintained, and the following is of special interest in this regard: For the year 1922, percentage of recovery,

copper, 91.59; gold, 74.28; 1923, copper, 93.90; gold, 77.78; 1924, copper, 94.90; gold, 79.89; 1925, copper, 96.68; gold, 83.48. Increased efficiency obtained in concentration plant has, it is said, been altogether negatived by the generally higher costs prevailing as the result of the decreased tonnage available following on the movement underground. The return of dollar rate exchange to approximately par has resulted in premium on gold practically disappearing, the amount of premium to be secured not now being sufficient to recoup cost of shipping gold; therefore Gold Producer's Association decided to liquidate. This loss will further reduce company's income.

Cresson Consolidated Gold Mining Co.

Gold; Colorado

The Cresson Consolidated Gold Mining Co. reports net earnings for the quarter ended June 30, 1925, of $101,762. This compares with $195,277 for the first quarter and $169,151 for the second quarter in 1924. Cash on hand and in bank June 30, 1925, was $1,297,666. This compares with $1,310,544 on March 31, 1925, and $1,050,878 on June 30, 1924. The net tonnage of ore milled in second quarter was 25,357, with average value $16.24 a ton. This compares with 28,099 tons and average value of $19.64 in first quarter. Gross production from the company's inception to June 30, 1925, totaled $26,930,674 and total dividend disbursements $10,654,272.

Marketing Trust Big Factor in Greek Magnesite Industry

Although Greek magnesite is superior to other deposits, this industry has relatively little development, according to C. E. Dickerson, Jr., trade commissioner at Athens. The official figures for production during the last five years show 71,870 metric tons in 1920, 58,249 in 1921, 56,642 in 1922, 57,783 in 1923, and 58,200 in 1924. It is apparent that production has decreased noticeably since 1920, and a still greater decline has occurred since the war period—1916 production, for example, amounted to 223,484 tons.

Among the reasons advanced for the reduced output are the poor organization in Greece, both for extracting and marketing magnesite, and the increased Austrian competition. Additional causes are the limited foreign as well as domestic demand, the instability of the drachma, and the acute labor situation in the mining industry. Foreign demand, however, lately has improved, although production costs and high freight rates have advanced the price of Greek magnesite to a figure that makes competition in foreign markets difficult.

Some months ago, owing to keen competition between the larger and smaller magnesite producers in Greece, the price of the ore fell off sharply. At present, prices for the raw product range about 32 to 35s. per ton f.o.b. kilns. Calcined magnesite is quoted at 110s. per ton f.o.b. kilns. During the war the price of the calcined product reached £10 per ton.

Exports for 1924 totaled 53,726,000 kg., compared with 33,928,000 kg., in 1923 and 28,286,000 kg., in 1922.

The development that has probably done most to strengthen and consolidate the foreign demand during the last year is the formation of a trust, known as the Grecian Magnesite Marketing Co., of London, by the Anglo-Greek Magnesite Co., the largest producer; the Van Mannekus Co., large Dutch buyer; and the Huyzers Megnesite Co., which is understood to own the only magnesite calciner in Greece. This trust resulted from the competition among the Greek producers that forced the price down. The trust endeavors to produce one grade of calcined magnesite and to fix a standard price for the product. It is possible to buy in Greece outside this trust only if small quantities of magnesite are ordered, as the small unorganized Greek producers do not account for more than one-third of the total Greek output. This difficulty in buying, and the endeavor to establish a monopoly under British control have caused some concern to American firms in need of the special high-grade Greek calcined magnesite. This grade at present has no equivalent except in India, where production is also controlled by an English company. The large quantity exported from Greece in 1924 was taken in great part by the new trust.

Mining Dividends Improve in July

The following dividends were paid by mining and metallurgical companies, operating in the Americas, in July, 1925:

Companies in the United States	Situation	Per Share	Total
Arizona Commercial, c.	Ariz.	$0.50 SA	$132,500
Eagle-Picher Lead, pfd.	Okla.	1.50 Q	12,984
Gladstone Mountain, l	Wash.	0.005	6,609
Homestake Mining, g.	S. D.	0.50 M	125,580
Inspiration Consolidated Copper	Ariz.	0.50	590,983
Kennecott Copper.	Alaska	0.75 Q	3,252,971
Magma Copper	Ariz.	0.75	306,116
New Jersey Zinc	Various	2.00 X	909,328
Nichols Copper pfd.	N. Y.	1.75 Q	40,434
Park City M. & S., s,l,z.	Utah	0.15 Q	131,400
Phelps Dodge, c.	U. S. and Mex.	1.00 Q	500,000
Republic Iron & Steel pfd.	Various	1.75 Q	437,500
Silver King Coalition, s,l	Utah	0.25 Q	304,025
Sloss-Sheffield Steel & Iron pfd.	Ala.	1.75 Q	117,250
U. S. Smelting, Refining & Mining pfd.	Various	0.875 Q	425,556
U. S. Smelting, Refining & Mining	Various	0.75 Q	263,336
Utah Apex, l,c,s,g	Utah	0.35 Q	184,870
Virginia Iron, Coal & Coke pfd.	Various	2.50 SA	125,000
Companies in Otner Countries			
Ahumada Lead, l,s	Chihuahua	0.25 Q	296,754
Asbestos Corporation pfd.	Que.	1.50 Q	60,000
Consolidated Mining & Smelting	B. C.	0.75 SA	320,167
Dome Mines, g.	Ont.	0.50 Q	500,000
Erupcion, l,s.	Chihuahua	0.25 Q	312,500
Great National Mexican Smelting s,l.	Coahuila	21.00	.....
Hollinger Consolidated Gold.	Ont.	0.08 4 wks.	393,600
Lorrain Trout Lake, s.	Ont.	0.05 Q	75,000
Mining Corporation, s.	Ont.	0.125	207,506
N. Y. & Honduras Rosario, g,s.	Honduras	0.50 Q	100,000
Nipissing Mines, s.	Ont.	0.15 Q	180,000
Premier Gold, s,g.	B. C.	0.08 Q	400,000
Silversmith, s,l,z.	B. C.	0.01 Q	25,000
Wright-Hargreaves, g.	Ont.	0.05 Q	137,500
Total.			$10,874,469

c, copper; l, lead; g, gold; s, silver; z, zinc; Q, quarterly; SA, semi-annually; M, monthly; X, extra.

Dividends for July again show a moderate increase over those for the preceding corresponding quarters, which were $10,367,139 in April, and $9,490,521 in January. Inspiration Copper resumed its 50c. quarterly dividend, which was allowed to lapse after the Jan. 7, 1924, payment. Magma was another copper company to resume paying dividends, this being the first since Jan. 6, 1919, when 50c. per share was distributed. The current dividend is presumably intended to be a quarterly affair. New Jersey Zinc found a millon dollars extra for its fortunate stockholders, the regular dividend of the same amount not being due till next month. Silver King Coalition reflected the good condition of that property by paying 25c. instead of 20c. per share as in April. On the other hand, Cresson Consolidated Gold evidently decided to conserve its resources, as nothing has been heard of the usual 10c. quarterly dividend due this month, and Tonopah Extension decided to keep its money to help take care of disorganized mine conditions.

Among the companies outside of the United States, Erupcion again increased its dividend, 25c. per share being paid this month, the same as Ahumada. Great National Mexican Smelting, operating the Reforma mine in Coahuila, made its fourth distribution of the year, the total for 1925 so far being $97 per share. The total number of shares is not made public, the stock being owned largely by the Guggenheims, so that it is purely a family affair. In Ontario, the Mining Corporation finally came to life, so far as the needy stockholder is concerned, with the first dividend in five years. Its operations in the South Lorrain district are, of course, responsible.

Transvaal Gold Production

Production of Transvaal gold mines declined in June, although the number of working days was twenty-six, the same as in May. Figures follow:

Figures in Fine Ounces

	1919	1920	1921	1922	1923	1924	1925
Jan.	676,059	670,503	651,593		764,469	796,768	823,629
Feb.	636,728	625,330	558,137	639,728	704,976	760,617	753,995
March	712,379	707,036	671,123		761,586	795,671	822,427
April	694,944	686,979	681,382	511,338	743,651	768,923	787,519
May	724,995	669,041	687,776	629,786	786,564	809,003	813,249
June	702,379	715,957	678,490	675,697	755,309	773,053	780,000
July	725,497	786,099	689,555	730,635	754,306	829,437	.....
August	706,669	702,083	711,526	752,490	769,371	809,571	.....
Sept	698,558	682,173	691,026	747,089	739,504	799,422	.....
Oct.	723,722	662,472	707,825	778,159	793,842	827,583	.....
Nov.	677,970	633,737	704,236	764,476	708,638	802,313	.....
Dec.	650,791	632,215	681,847	790,712	778,849	825,273	.....
Totals	8,330,091	8,153,625	8,114,516	7,020,110	9,133,060	9,597,634	.....

Current Prices of Mine Materials and Supplies

Rise and Fall of the Market

Aside from slight fluctuations in prices of such materials as wire nails and track supplies, and decided firmness in Western pipe quotations, the majority of the changes of the month were downward. The down-trend affected steel, particularly sheets, pine and fir timbers, linseed oil, air and water hose, belting and rope.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.25@2.30	$3.90	$3.50	$3.70	$3.89
Black No. 28	3.10@3.20	4.80	4.00	4.65	4.35
Galvanized No. 28	4.15@4.25	5.80	5.00	5.75	5.35

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, 9/16-in. and larger	$2.80	$2.90@3.00	$3.55	$3.65	$4.35	$2.90
Track bolts	3.90@4.00	3.75@4.25	4.55	4.65	5.85	3.90
Standard section angle bars	2.75	2.75	3.30	3.40	4.00	3.85

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.00	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channel, 3 to 15 in.	2.00	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 6 in., 1/4 in. thick	2.00	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	2.00	2.10	3.34	4.15	3.35	3.10	3.30
Plates	2.00	2.00	3.34	4.15	3.25	3.10	3.30

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	55%	60%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD—	1 to 3	62	50½	1 to 1½	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
3½ to 6 in. lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$50.60–51.60	$60.60–61.60	$40.00 base	$48.20–50.20	$47.60	$52.00

NUTS—Semi-finished, ½x½-in., 2c. each. Discount 70% for 9/16-in. and smaller; 65% for ⅝-in. and larger. Case hardened, 6c. each, less 50%.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1162	$0.1162	$0.06	$0.1325	$0.078	$0.108	
6x12x12	.1743	.1743	.0825	.....	.102	.156	$0.252*
8x12x12	.2179	.2179	.1125	.25	.14	.244	.312†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—½x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	St. Louis 20 Ft. and Under	St. Louis 22-24 Ft.
3x4 to 8x8	$45.00	$46.00	$39.00	$41.00
3x10 to 10x10	49.00	50.00	43.00	45.00
3x12 to 12x12	54.00	55.00	48.00	50.00

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$50.00	$48.00†	$50.00	$50.00	$60.00	$58.00†
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Denver	.....	35.75	35.75	35.75	.....	36.25
Minneapolis	43.00	38.75	35.00	.....	44.50	38.75
Kansas City	41.00	40.75	.....	.....	52.00	41.75
Birmingham	32.00	.....	.....	.....	34.00	.....

* Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.75	$3.15	$3.85	$4.50	$3.33	$4.95
Cut	2.90	....	5.25	5.00	3.58	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.50@2.60	$2.50@2.60	$2.50@2.60
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.39	2.39	2.39

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel 280-lb. net Common
New York	$18.20	$12.@13.10	$3.50	$2.50@$2.75
San Francisco	.....	22.00	....	(180-lb. net) 1.60

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$1.04	$0.98	$1.23	$0.94

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	15.75	15.00	17.25	16.50
White	15.75	15.00	15.75	15.00

HOSE—Quotations at New York warehouses:

Fire Protection — 50-Ft. Lengths

Underwriters' 2½-in. coupled, single jacket ..... 65c per ft.

Air—Best Grade

¾-in., per ft. ..... 3 ply $0.36 4 ply $0.44

Steam—Discounts from List

First grade ..... 40% Second grade ..... 40–5% Third grade ... 40–10%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.

Best grade ..... 50–5% Second grade 50–10–5%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40%
Heavy	30–10%

RAWHIDE LACING—For cut, best grade, 50%, 2nd grade, 60%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 50%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ¼ in.	$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.23	New Orleans	$0.26½
New York	27	Seattle	.17
Chicago	21½	San Francisco	26

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.233	.26
San Francisco	1625	.1925

FLOTATION OIL—

Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.30

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.09
Litharge, f.o.b. New York, kegs, per 100 lb.	15.75
Sodium cyanide, 220 lb. single case lots, f.o.b. works, per lb.	.18@.22

Mining Stocks—Week Ended July 18, 1925

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda	New York	43½	40⅞	43½	Jy.18, Au.24, Q 0.75
Arcadian Consol.	Boston			1¼	
Ariz. Com'l.	Boston	12⅛	11½	11⅝	Jy.21, Jy 31 SA 0.50
Calaveras	N. Y. Curb			2	
Calumet & Arizona	New York	51⅛	49⅞	50½	Jn.15, Jn.22 Q 0.50
Calumet & Hecla	Boston	51	50½	50½	Ja.30, Mh.4 0.50
Canario Copper	N. Y. Curb	7⅛	6½	7½	
Cerro de Pasco	New York	54½	53½	54	Au 21, Se.1, Q 1.75
Chile Copper	New York	35	34⅜	35	Jn.3, Jn.29, Q 0.62½
Chino	New York	24⅛	23	24⅛	Sept., 1920 0.37½
Con. Coppermines	N. Y. Curb	2⅛	2⅛	2⅛	
Copper Range	Boston	22	20⅛	21⅛	Ap.9, My.4 1.00
Crystal Copper	Boston Curb	*53	*46	*51	
East Butte	Boston	4⅛	4	4	Dec., 1919 0.50
First National	Boston Curb	*21	*20	*20	Feb., 1919 0.15
Franklin	Boston			*90	
Granby Consol.	New York	16⅛	15½	16⅛	May, 1919 1.25
Greene-Cananea	New York	14⅞	14⅛	14⅜	Nov., 1920 0.50
Hancock	Boston			*76	
HoweSound,new,r.t.c.	N. Y. Curb			16½	April, 1924 0.05
Inspiration Consl.	New York	29⅛	28⅛	28⅛	Jn.18, Jy.6, Q 0.50
Iron Cap	Boston Curb	1⅛	1⅛	1⅛	May, 1923 0.15
Isle Royale	Boston	14⅛	13⅛	14	Sept., 1923 0.50
Jerome Verde Dev.	N. Y. Curb	1	1	1	
Kennecott	New York	54⅛	53	53⅛	Jn.5, Jy.1, Q 0.75
Lake Copper	Boston	1⅛	1⅛	1⅛	Jn.1, Jn.15 Q 0.50
Magma Copper	NewYork	42⅛	41⅛	42⅛	Jn. 15, Jy. 15, 0.75
Mason Valley	N. Y. Curb	2	1⅞	1⅞	
Mass Consolidated	Boston	*70	*70	*70	Nov., 1917 1.00
Miami Copper	New York	11	10⅛	10⅜	Au.1 Au.15 Q 0.25
Mohawk	Boston	32⅛	30	32	Aug. 1, Sept. 2 1.00
Mother Lode Con.	New York	7⅞	7⅛	7⅞	Jn. 12, Jn. 30 0.37½
Nevada Consol.	New York	13⅜	12⅛	13⅛	Sept., 1920 0.25
New Cornelia	Boston	21	20	21	My. 8, My. 25Q 0.25
North Butte	Boston	1⅛	1⅛	1⅛	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	*85	*80	*85	No.14, De.2 0.05
Old Dominion	Boston	20⅜	20	20⅛	Dec., 1918 1.00
Phelps Dodge	Open Mar.	†110	†105		Jn 20, Jy.2 Q 1.00
Quincy	Boston	26½	23⅞	26	Mar., 1920 1.00
Ray Consolidated	New York	15⅞	13⅛	15⅛	Dec., 1920 0.25
Ray Hercules	N. Y. Curb			14	
St. Mary's Min Ld.	Boston	38	35⅛	37	Ap. 20, My.20, 3.00
Shannon	Boston	*75	*70	*70	Nov., 1917 0.25
Shattuck Arizona	New York	7⅛	6⅛	7	Jan., 1920 0.25
Superior & Boston	Boston	1⅛	1	1⅛	
Tenn. C. & C.	New York	12⅛	11⅛	12	De.31, Ja.15,Q 0.25
United Verde Ex.	N. Y. Curb	24⅛	24⅛	24⅛	Jy. 6, Aug. 1 0.50
Utah Copper	New York	95⅛	93⅛	95⅛	Mh.20,Mh.31,Q1 00
Utah Metal & T.	Boston	*72	*55	*56	Dec., 1917 0.30
Victoria	Boston	*37	*37	*37	
Walker Mining	Salt Lake	2.57½	2.55	2.55	
NICKEL-COPPER					
Internat. Nickel	New York	30⅛	29⅛	29⅞	March, 1919 0.50
Internat. Nickel pfd.	New York	99⅛	98⅛	98⅛	Jy.16, Au.1, Q 1.50
LEAD					
Carnegie Lead & Zinc	Pittsburgh	7⅛	7⅛	7⅛	
Gladstone M. M. Co.	Spokane	*22½	*22	*22½	Jy. 1, Jy. 10 0 0½
National Lead	New York	151	148	149	Jn.12, Jn.30, Q 2.00
National Lead pfd.	New York			118	My.22, Jn.15 Q 1.75
St. Joseph Lead	New York	42	37½	42	Jn. 9, Jn. 22 0.50
ZINC					
Am. Z. L. & S.	New York	8⅛	8	8⅛	May, 1920 1.00
Am. Z. L. & S. pfd.	New York	30⅛	28	30⅛	Nov., 1920 1.50
Butte C. & Z.	New York	6⅛	5⅛	6⅛	De.10, De.24 0.50
Butte & Superior	New York	12⅛	10⅞	12⅛	Mh.19, Mh.31 0.50
Callahan Zn-Ld.	New York	2⅛	2⅛	2⅛	Dec., 1920 0.50
New Jersey Zn.	N. Y. Curb	194	187	191	Jn.20,Jy.10 Ex. 2.00
United Zinc	N. Y. Curb			*35	
Yellow Pine	Los Angeles	*71½	*70	*71½	De.10,De.15 Q 0.04
GOLD					
Alaska Juneau	New York	1⅛	1⅛	1⅛	
Argonaut	Toronto	*26	*25	*25½	
Barry-Hollinger	Toronto	*43	*41	*42	
Carson Hill	Boston	*25	*25	*25	
Consol. W. Dome L.	Toronto	*13⅜	*13	*13⅛	
Cresson Consol. G.	N. Y. Curb	3⅛	3	3	Mh.31, Ap.10 Q 0.10
Crown Reserve	Toronto	*25	*23½	*24½	Jan., 1917 0 05
Dome Mines	New York	15⅞	14	15⅛	Mh.31, Ap.20, Q 0.50
Golden Cycle	Colo. Springs			1.45	Dec.11, 1924 0.03
Hollinger Consol.	Toronto	14.80	14.65	14.75	Jy.27, Au.12 0.08
Homestake Mining	New York	44	44	44	Jy.20, Jy.25 M 0.50
Kirkland Lake	Toronto	*40	*38½	*39½	
Lake Shore	Toronto	5.95	5.85	5.92	Mh.2, Mh.16, 0 05
McIntyre-Porcupine	New York	18	17½	18	Aug.1, Sept.1 0.25
Newray	Toronto	*22	*21	*21	
Night Hawk Pen.	Toronto	*24	*23	*23	
Portland	Colo. Springs			*35	Oct., 1920 0.01
Rand Mines	New York			37	Fe.17, Fe.25 1.79
Teck-Hughes	Toronto	1.59	1.43	1.58	
Tom Reed	Los Angeles	*58½	*48	*58½	Dec., 1919 0.02
Tough-Oakes	Toronto	*36	*34½	*35½	
United Eastern	N. Y. Curb	*47	*45	*45	July, 1924 0.05
Vipond Cons.	Toronto	1.08	1.05	1.06	
Wright-Hargreaves	Toronto	4.90	4.61	4.85	Jn.15, Jy.1 5.00
GOLD AND SILVER					
Black Oak	N. Y. Curb			*81	
Con. Cortez	N. Y. Curb	*7	*7	*7	
Con. Virginia	San Francisco	4⅛	3⅛	4⅛	
Continental Mines	N. Y. Curb			1⅛	
Dolores Esperanza	N. Y. Curb	*55	*50	*50	July, 1923 0.05
Premier Gold	N. Y. Curb	2⅛	2 1/16	2⅛	Jn.18, Jy.1, 0.08
Tonopah Belmont	N. Y. Curb	*60	*55	*60	Mh.15, Ap.1 0.05
Tonopah Divide	N. Y. Curb			*23	Oct., 1923 0.10
Tonopah Extension	N. Y. Curb	1⅛	1⅛	1⅛	Mh.11, Ap.1, Q 0.05
Tonopah Mining	N. Y. Curb	3⅛	3	3⅛	Mh.31, Ap. 21, 0.07½
Unity Gold	N. Y. Curb	*85	*80	*80	
West End Consol.	N. Y. Curb	*50	*50	*50	Mar., 1923 0.05
Yukon Gold	N. Y. Curb			*35	June, 1918 0.02

Stock	Exch.	High	Low	Last	Last Div.
SILVER					
Alvarado	Boston Curb			*50	Oct. 1920 0.50
Beaver Consol.	Toronto	*30	*29	*29½	May, 1920 0.03
Castle-Trethewey	Toronto	*93	*87	*92	
Coniagas	Toronto	1.65	1.55	1.55	May, 1924 0.12½
Keeley	Toronto	1.76	1.75	1.75	Mh.1, Mh.15SA 0.12
Kerr Lake	N. Y. Curb	1⅛	1⅛	1⅛	Ap.1, Ap.15, Q 0.12½
La Rose	Toronto	*48½	*46½	*47	Apr., 1922 0.10½
Lorrain Trout Lake	Toronto	1.03	*95	1.02	Jy. 2, Jy.15 0 05
McKiniey-Dar.-Sav.	Toronto	*29½	*28½	*28⅜	Oct., 1920 0.03
Mining Corp. Can.	Toronto	2.63	2 57	2.60	Jy.1, Jy.15 0.12½
Nipissing	N. Y. Curb	4⅛	4⅛	4⅛	Jn.30, Jy.20, Q 0.15
Ontario Silver	New York	6⅛	6	6⅛	Jan., 1919 0.50
Temiskaming	Toronto	*17	*16½	*16½	Jan., 1920 0.40
SILVER-LEAD					
Ahumada	New York	14⅛	10⅛	11	Jn.15,Jy.2,QEx 0.25
Bingham Mines	Boston	29⅛	29⅛	29⅜	Jn.20, Jn.30 Q 0.50
Cardiff M. & M.	Salt Lake	1.37½	1.32½	1.37½	De.16, No.18 0.10
Chief Consol.	Salt Lake	3.52	3.52	3.52	Ap 10, My. 1 0.10
Columbus Rexall	Salt Lake	*9½	*9¼	*9½	Aug., 1923 0.05
Eruption	Boston Curb	3 1/16	3	3 1/16	Jn.15,Jy.2,QEx 0.25
Federal M. & S.	New York	17⅞	17½	17½	Se.26, Mh.15 Q 1.75
Federal M. & S. pfd.	New York	58⅜	56⅞	58	My.25, Jn.15,Q 1.75
Hecla Mining	N. Y. Curb	14⅜	14⅛	14⅜	My 15, Je.15 Q 0.50
Iron Blossom Con.	Salt Lake			*39	Oc.25, 1924 0.01½
Iron King Mining	Salt Lake	*56	*51	*51	
Keystone Mining	Salt Lake	*81	*80	*80	Au.12 Au.26 0 07½
Mammoth Mining	Salt Lake	2.45	2.25	2.45	My.15 My.25 0.10
Marsh Mines	N. Y. Curb			*4	June, 1921 0.02½
Park City	Salt Lake	5.95	5.90	5.90	Jn.15, Jy.1 Q 0.15
Park Utah	Salt Lake	5.95	5.90	5.90	April, 1924 0.15
Prince Consol.	Salt Lake	*47	*43	*47	
Silver King Coal	Salt Lake	8.15	8.00	8.15	Jn.20, Jy 1, Q 0.25
Silversmith	Spokane	*17⅜	*17½	*17⅜	Jy.1, Jy.10 0.01
Tamarack-Custer	Spokane	*75	*72	*75	Sept., 1924 0 25
Tintic Standard	Salt Lake	11.00	11.00	11.00	Jn.24, Jn.29 Q 0.40
Utah-Apex	Boston	6⅛	5⅞	5⅞	Jy.3, Jy.15, Q 0.35
Western Utah Copper	N. Y. Curb			*11	
IRON					
Bethlehem Steel	New York	43⅛	40⅜	43	July, 1924 1.25
Char. Iron	Detroit			*20	
Char. Iron pfd.	Detroit			*85	
Colorado Fuel & Iron	New York	43⅛	41¼	41⅜	May, 1921 0.75
Gt. North'n Iron Ore	New York	30	29	29⅜	Ap.11, Ap.30 1.00
Inland Steel	New York	41⅛	40	41⅛	My.15, Jn.1 0.62½
Mesabi Iron	N. Y. Curb	2⅛	2	2⅛	
Replogle Steel	New York	16⅛	14	15⅛	
Republic I. & S.	New York	48⅞	45⅞	48⅛	May, 1921 1.50
Republic I. & S. pfd.	New York	88	87½	88	Jn.17, Jy.1, Q 1.75
Sloss-Sheffield S. & I.	New York	99	91	97½	Jn.10, Jn.20 Q 1.50
Sloss-Shef. S.&I. pfd.	New York	95	95	95	Jn.20, Jy.1, Q 1.75
U. S. Steel	New York	119⅞	115⅜	119⅛	Jn.1, Jn.29, OX 1. 5
U. S. Steel pfd.	New York	124⅜	124½	124½	My.5, My 29, Q 1.75
Virginia I. C. & C.	New York			31	Jan., 1924 1.50
Virginia I.C.&C.pfd.	New York			73	Jn.20, Jy.2, 2.50
VANADIUM					
Vanadium Corp.	New York	34⅛	30½	30½	Aug.1, Aug.15 0.50
ASBESTOS					
Asbestos Corp.	Montreal	83½	68	70½	My.1, My.15 Q 1.00
Asbestos Corp., pfd.	Montreal	114	101	104½	Ap. 1, Ap. 15, Q 1.50
SULPHUR					
Freeport Texas	New York	16⅛	14½	15⅞	Nov., 1919 1.00
Texas Gulf	New York	112⅞	110⅛	110⅞	Jn.1, Jn.15, Q 1.75
DIAMONDS					
De Beers Consol.	New York	21⅞	21	21⅜	Jy.27, Au.30 0.97
PLATINUM					
So. Am. Gold & P.	N. Y. Curb	3	3	3	
MINING, SMELTING, REFINING AND GENERAL					
Amer. Metal	New York	49⅞	49	49⅜	My.19, Jn.1, Q 0.75
Amer. Metal pfd.	New York			115	My.20, Jn.1, Q 1.75
Amer. Sm. & Ref.	New York	106⅞	105⅛	106⅛	Jy.10, Au.1, Q 1.50
Amer.Sm.&Ref.pfd.	New York	110⅞	110	110⅞	Au.7, Se.1 Q 1.75
Consol. M. & S.	Montreal	98⅛	84⅛	96⅛	Jn.30, Jy.15 0.75
Federated Metals	N Y. Curb	27	27	27	
Newmont Mining	N. Y. Curb	46⅛	45⅞	46	
Southwest Metals	N. Y. Curb	1	1	1	
U. S. Sm. R. & M.	New York	39⅛	38	39⅛	Jy.6, Jy.15 Q 0.75
U.S. Sm. R.&M.pfd.	New York	46	45⅞	45⅞	Jy.6, Jy.15 Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange.

LONDON QUOTATIONS, WEEK ENDED JULY 4

	High	Low	Last	Date	Per Cent
Aramayo Mines (25 frs.)	77/6	75/	76/10½	May 1925	5(c)
British Platinum	8/1½	7/9	7/9	Feb. 1925	2½
Bwana M'Kubwa	5/6	5/	5/3		
Camp Bird	2/4½	2/3	2/4½		
El Oro	5/6	5/1½	5/3	Nov. 1924	2½*
Esperanza	1/—	—/10½	—/10½		
Frontino & Bolivia	11/7½	11/3	11/6	July 1925	3¾
Mexican Corporation	13/—	12/3	12/9		
Mexico Mines of El Oro	37/6	35/—	37/6	June 1925	10*
Nechi (pref. 10s.)	1/6	1/3	1/4½	1921–22	25
Oroville Dredging	7/9	7/6	7/6	Dec. 1923	3¾
Ouro Preto	5/—	4/9	5/—	May 1925	2½
St. John del Rey	16/3	15/9	16/—	June 1925	6½
San Francisco Mines	23/4½	22/9	23/—	June 1925	15
Santa Gertrudis	10/6	10/—	10/3	July 1920	5
Selukwe (2s. 6d.)	11/7½	9/1½	10/3	April 1917	6¾
S. American Copper	7/6	6/9	7/—	Nov. 1917	75
Tanganyika	30/10½	28/9	28/9		
Tomboy	4/3	4/—	4/—	Feb. 1925	4½
Union Minière du Haut-Katanga (Brussels) 100 Fr	5.360	5.295	5.360	July 1924	80(b)

* Free of British income tax. (b) Belgian francs. (c) Swiss francs.